

COMPUTER SCIENCE

6

Based on Single National Curriculum 2022



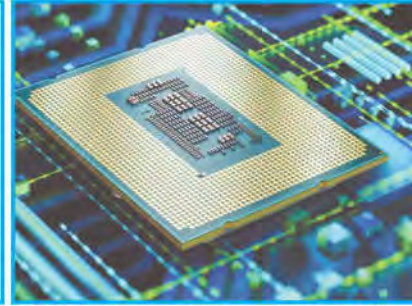
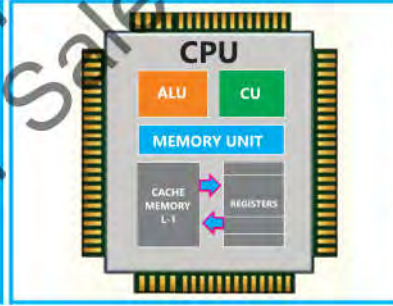
Punjab Curriculum and Textbook Board, Lahore

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

(In the Name of Allah, the Most Compassionate, the Most Merciful.)

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ONE NATION, ONE CURRICULUM



PUNJAB CURRICULUM AND
TEXTBOOK BOARD, LAHORE

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Contents

Unit	Topic	Page
1	ICT Fundamentals	1
2	Components of Computer System	12
3	Digital Skills	28
4	Algorithmic Thinking	53
5	Programming	64
6	Digital Citizenship	87
7	Entrepreneurship in Digital Age	96
	Answers	110

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ICT Fundamentals

Students Learning Outcomes

After completing this unit students will be able to:

- Define ICT (Information and Communication Technology)
- Define Computer.
- Differentiate between data and information, along with examples.
- Summarize the different developments in the history of Computers.
- Define hardware and software
- Identify advantages and disadvantages of daily applications of ICT e.g:
 - Communication applications
 - Measurement applications
 - Applications in manufacturing industries
 - Advantages & disadvantages of ICT devices
 - Applications of the ICT devices in business and daily life
- Identify various ICT devices
- Identify the use of ICT devices in:
 - Communication applications (print media, digital media, mobile phone, etc.)
 - Measurement applications (digital experiments, weather stations, navigation, etc.).
 - Applications in manufacturing industries (robotics used in manufacture and production line control).

1.1 Information and Communication Technology (ICT)

Information and Communication Technologies (ICT) is defined as a set of computing tools that collectively allow people and organizations to interact in the digital world. ICT is also used to refer to the merging of telephone networks with computer networks through a single link system. ICT is an umbrella term that includes communication devices, television, cell phones, computer and network hardware, satellite systems, as well as the various services and applications such as, video conferencing and distance learning etc.



Fig. 1.1 Information and Communication Technology (ICT)

1.2 Computer

Computers are electronic devices that accept data (input), process that data, produce output, and can store (storage) the results for future use. It also has the ability to retrieve data and information. A computer system includes the hardware, software, and peripheral devices.



Fig: 1.2 Computer System

1.3 Software

Software is a set of instructions, data or program used to operate a computer and perform specific tasks. In simpler terms, software tells a computer how to function. It refers to applications and programs that run on devices such as PCs, mobiles, tablets, and other smart devices. Among the various categories of software the most common types include the following:

Do you Know?
Charles Babbage is known as father of computer



Fig: 1.3 System software

1.3.1 System Software

System software is a type of computer program that is designed to run a computer's hardware and application programs. System software is the interface between the hardware and user applications. Operating System is the best-known example of system software. The OS manages hardware as well as all the other programs in a computer. Examples of system software include operating systems (OS) like Microsoft Windows, macOS, Linux and Android.

1.3.2 Application Software

Application Software is a type of computer program or software package that performs specific functions for a user. The functions, performed by application software, can be for an individual, for an organization or for an educational institute. Application software is also known as productivity software or end-user software.

The majority of apps that we see on our smartphones are examples of application software. Examples of application software include office suites, graphics software, databases, web browsers and image editors etc.



1.4 Application software

1.3.3 Driver Software

Driver software is also known as device driver. It is often considered a type of system software. Device drivers are used to control the devices and peripherals connected to a computer system. It also enables them to perform their specific tasks. Examples include game controllers, as well as the software that enables standard hardware, such as printers and scanners.

1.4 Computer Hardware

Computer hardware represents the physical and tangible components of a computer that can be seen and touched. Hardware and software are mutually dependent on each other. Both of them must work together produce a useful results or output. Computer hardware is divided into two main categories:

Do you Know?

CPU is also called
Brain of computer



Fig: 1.5 Computer Hardware



Fig 1.6 System Unit

1.4.1 System Unit

The system unit contains the components used to process and temporarily store data and instructions. These components include the Central Processing Unit (CPU), primary memory, and the system board.

1.4.2 Peripherals

Peripheral devices are hardware used for input, secondary storage and display etc. Peripherals are attached to the system unit through a hardware interface. We will discuss peripherals in detail later in this book.

1.5 History of Computer

Since the evolution of humans, devices have been used for calculations for thousands of

years. One of the earliest and most well-known devices was an abacus. Then in 1822, the father of computers, Charles Babbage began developing what would be the first mechanical computer. Then in 1833 he actually designed an Analytical Engine which was a general-purpose computer. Let us look at the important features of generations of computers.

1.5.1 1st Generation Computers

This was from the period of 1940 to 1955. Vacuum tubes were used for the circuitry in first generation computers. For the purpose of memory, magnetic drums were used. These machines were complicated, large, and expensive. Batch operating systems and punch cards were used in these machines. As output and input devices, magnetic tape and paper tape were used. Examples of first generation computers are ENIAC, UNIVAC-1 and EDVAC etc.



Fig: 1.7 Computer System

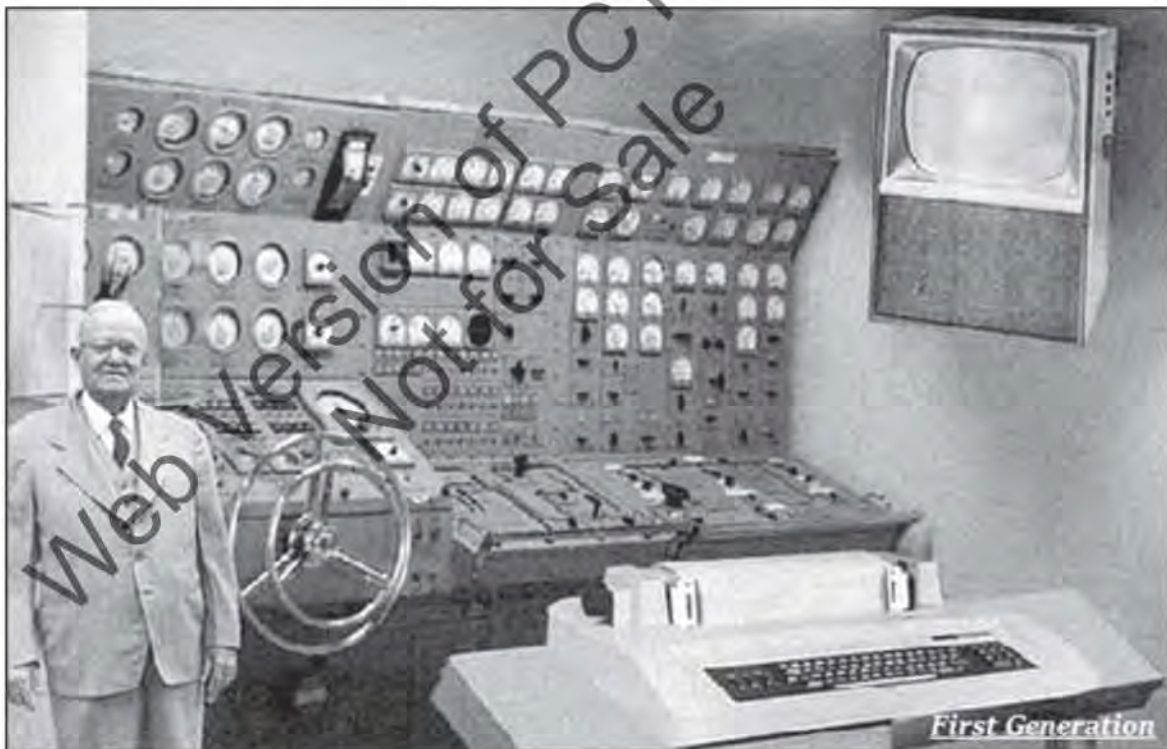


Fig 1.8 1st Generation Computers

Extra Bit!

Vacuum tubes required high voltage and produced more heat.

1.5.2 2nd Generation Computers

The years 1957-1963 are referred to as the "second generation of computers". COBOL, FORTRAN programming languages were used in this generation. In this generation vacuum tubes were replaced by transistors. Transistors made the computers smaller, faster and more energy-efficient. Examples of 2nd generation computers are IBM 1620, IBM 7094, CDC 1604 and CDC 3600 etc.



Fig 1.9 2nd Generation Computers

1.5.3 3rd Generation Computers

The period of 3rd generation was from 1964 to 1971. Integrated Circuit (IC) Technology was used in this generation. A single integrated circuit (IC) can replace many transistors. This technology increased the power of a computer and lowered its cost. These computers were quicker, smaller, more reliable, and less expensive than their predecessors. Programming languages FORTRAN-II to IV, COBOL, and PASCAL PL/1 were used in this generation. Examples of 3rd generation computers are IBM-360 series, the Honeywell-6000 series, and the IBM-370/168 etc.



Fig 1.10 3rd Generation Computers



Fourth Generation

Fig 1.11 4th Generation Computers

1.5.4 4th Generation Computers

Microprocessors were introduced in fourth generation of computers. The years 1971-1980 are referred to as fourth generation computers. C, C++ and Java were the programming languages used in this generation. Examples of fourth generation computers are STAR 1000, PDP 11, CRAY-1, CRAY-X-MP, and Apple II.

1.5.5 5th Generation

These computers have been utilized since 1980 and continue to be used till now. This is the present as well as future of the computer world. The defining aspect of this generation is artificial intelligence.



Fig 1.12 5th Generation Computers

1.6 ICT Devices

ICT surrounds us everywhere. In every home, in every school or workplace, you can find at least a couple of ICT devices or gadgets. Some of ICT devices are given below:



Fig 1.13 ICT Devices

1.6.1 Applications of ICT Devices

Information and Communication Technology has become the life style of people. ICT is used in almost every field of life such as e-Commerce, e-governance, banking, agriculture, education, medicine, defense and transport, etc. Following are some applications of ICT devices in everyday life:

1.6.2 ICT Applications in Communication

ICT can be used to help in communication. This communication can be paper based or it can be digital communication. Range of communication applications include print media, digital media and mobile media. Examples of communication applications are:

- Newsletters
- Posters
- Websites
- Multimedia presentations
- Music scores
- Cartoons
- Flyers



Fig 1.14 ICT in Communication

1.6.3 ICT Application in Measurement

ICT devices are much better at reading and measuring data taken from different sensors. Following examples show, how sensors and ICT devices can be used to measure data:

Digital Experiments

Data logging, data monitoring and recording and data generated during scientific experiments can be managed more efficiently using ICT tools or devices such as computers.

Environmental Monitoring

Environmental monitoring is where we collect data for weather forecasting, level of air pollution and for water level in rivers and streams etc.

Navigation

Navigation systems are used for monitoring and controlling the movement of a craft or vehicle from one place to another. Navigation system is further divided into four categories:

- Land navigation
- Marine navigation
- Aeronautic navigation
- Space navigation

Modern ICT devices are widely used in navigation system.

1.6.4 ICT Application in Manufacturing Industry

ICT devices are used in different industries. The entry of ICT devices in industry has revolutionized the manufacturing industry and led to the industry towards development of the heavy machines. ICT has increased the productivity of industries and saved production time. ICT tools are being used in various industries for various purposes such as:

- Welding parts of the cars
- Paint spraying cars in car factories
- Manufacturing microchips
- Lifting heavy parts of the cars
- Packing goods into boxes
- CPU manufacturing
- 3D printing
- Washing cars



Fig 1.15 GPS system for Weather Forecasting



1.6.5 ICT Application in Business

ICT includes technology that assists individuals, businesses and organizations. ICT makes business more efficient and effective. ICT can support various business activities such as design, manufacturing, R&D, distribution and collecting and evaluating sales and feedback etc. ICT systems can also be used in reducing costs, increasing efficiency, improving decision-making and increasing your competitiveness in the marketplace. In business ICT can be helpful in:

- Better Decision Making
- Increasing productivity
- Improving customer services
- Improving financial matter

1.7 Advantages of ICT Devices

The advantages of ICT in everyday life are enormous. Some advantages of ICT are as under:

- ICT is Eco-friendly because has eliminated the use of paper.
- ICT has improved teaching and learning mechanism.
- Management of teachers and students is simple because of ICT.
- ICT has automated manual processes and procedures.
- Web-based LMS technologies connect students, teachers and researchers together.
- During classes, teachers can use photos, videos, and graphics to teach more effectively.
- ICT promotes and improves the digital culture in schools, colleges, and universities.
- ICT provides independent learning platforms for students
- ICT has enhanced data and information security
- ICT is bridging the cultural divide by allowing individuals of different cultures to communicate with one another.
- ICT has revolutionized almost every field of life.

1.8 Disadvantages of ICT Devices

Just like any other technology, ICT comes with certain limitations. Some of the drawbacks or disadvantages of using ICT devices are as under:

- Misleading and misguiding information
- Risk of cyber-attacks and hacks
- A risk to the traditional book and handwriting methods
- Managing courses online is difficult for teachers
- Misuse of technology by students
- Not accessible everywhere
- Expert person are required to handle ICT
- Implementation of ICT is expensive

Summary

- ICT stands for Information and Communication Technology. It includes all technologies used for communication.
- Raw collection of facts and figures is called data while processed form of data is called information.
- Computer is divided into five generation based on technologies i.e., vacuum Tube, Transistors, IC, CPU chips and AI used in first, second, third, fourth and fifth generations respectively.
- Computer system consists of hardware and software. Hardware refers to physical parts that can be seen or touched while software is set of instructions given to computer to perform a specific task.
- Input Devices are devices used to enter data in computer.
- Output devices are used to display the result of processing.
- In Manufacturing industries ICT devices are used to lift heavy objects, welding parts, packing goods and 3D painting etc.
- ICT device are also used in application measurement and in business.



Exercise

Tick (✓) the Correct option:

1. ICT is an umbrella term that includes:
a. television b. cell phones c. communication devices d. All
2. Set of instruction given to a computer to perform specific task is called:
a. hardware b. software c. both a and b d. none
3. Software that is designed to run computer's hardware is called:
a. application software b. utility software
c. system software d. embedded software
4. Operating System is an example of
a. application software b. utility software
c. system software d. embedded software
5. MS. Office is an example of
a. application software b. utility software
c. system software d. utility software
6. CPU is also called:
a. heart of computer b. lungs of computer
c. hands of computer d. brain of computer
7. _____ is called father of computer:
a. Pascal b. Charles Babbage c. Howard Aiken d. Al-Khwarizmi

8. The system used to control and monitor movement of cars and crafts is called:
a. communication system b. navigation system
c. environment management d. digital experiments
9. ICT is Eco-friendly because it has eliminated the use of _____.
a. computer b. mobiles c. printers d. papers
10. ICT devices are used in different industries for:
a. picking goods b. lifting heavy parts c. 3D printing d. all

Briefly answer the following questions

1. Define ICT, how is it helpful in everyday life?
2. Differentiate between data and information.
3. Enlist basic components of a computer.
4. Why CPU is called brain of computer?
5. Enlist any three computers of first generation.
6. Write a note on 5th generation of computers.
7. Enlist any five devices of ICT.
8. Discuss applications of ICT devices in Business.
9. Write down any five advantages of ICT devices.
10. Write down any five disadvantages of ICT devices.

Answer the following questions in detail

1. Discuss three types of software.
2. Differentiate between second and third generations of computer.
3. Discuss applications of ICT in manufacturing industries.
4. Where do we use Navigation System and how does it work?
5. Differentiate between hardware and software.

Write the functions of following ICT devices

1. Printer
2. Keyboard
3. Scanner
4. Monitor
5. Smart Phone

Activity Based Questions

1. Make a chart of ICT Devices and display it in your classroom
2. Identify ICT devices and encircle them.



3. Divide the students into pairs.

Ask the students to brainstorm three or four activities they can accomplish with a computer. Encourage them to think about people they know who use the computer for their studies/work/play. What is the input used for that activity? What is the output? Have students brainstorm within their groups, record their ideas on the activity guide/page/board/poster and ask them to make a list of input and output devices. Point students towards the list of inputs and outputs you have listed on the board or students have jotted down.

UNIT 2

Components of Computer System

Students Learning Outcomes

After completing this unit students will be able to:

- Identify Hardware components of a computer
- Input Devices (mouse/keyboard/ scanner / microphone, OCR, touch devices, digital camera and sensors etc.)
- Identify output Devices (LCD/LED/SMD, printer, speakers and multimedia projector etc.)
- Recognize a computer and its external components.
- Apply their knowledge to operate computer devices (like mouse/keyboard/printer & touch devices)
- Summarize how a computer processor works (input, processing, and output)?
- Identify types of computer memory (RAM and ROM)
- Recognize the types of storage (SSD, HDD, and External storage)

Introduction

In simple words, computers are machines that perform operations according to instructions given by users. A computer comprises of some basic elements. These elements include hardware and software. Computer cannot work without these elements. Let's take a look at them in detail.

2.1 Basic Components of Computer

Components of a computer system are the primary elements which make its functioning smooth and faster. There are five basic components which include:

- Input Devices
- Output Devices
- Memory Unit
- Control Unit
- Arithmetic and Logical Unit

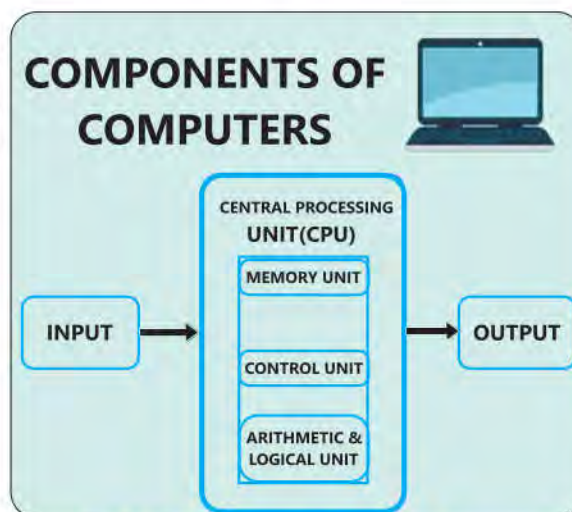


Fig 2.1 Components of Computer System

2.2 Input Devices

A computer works according to the commands/ instructions given to it. These commands can be given using devices that are called. For example using a keyboard we can type things on a Notepad and the computer processes the entered data and then displays the output on the screen.

These instructions can be in the form of numbers, alphabet and images, etc. We enter data using an input device, the processing units convert it into computer understandable form and then the final result is received in a human-understandable form. Some of input devices are:

- Keyboard
- Mouse
- Joy Stick
- Light pen
- Scanner
- Microphone
- Optical Character Reader(OCR)
- Bar Code Reader



Fig 2.2 Input Devices

Extra Bit!

Data: Raw collection of fact and figure is called data.

Information: processed form of data which is understandable by a common person is called information.

Input: Data that we give to a computer is called input.

Output: Information provided by computer after processing is called output.

Processing: The procedure of converting data into information is called processing.

2.2.1 Keyboard

Keyboard is the most common and very popular input device. It helps to input data into the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for additional functions. Keyboards are of two sizes, 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available.

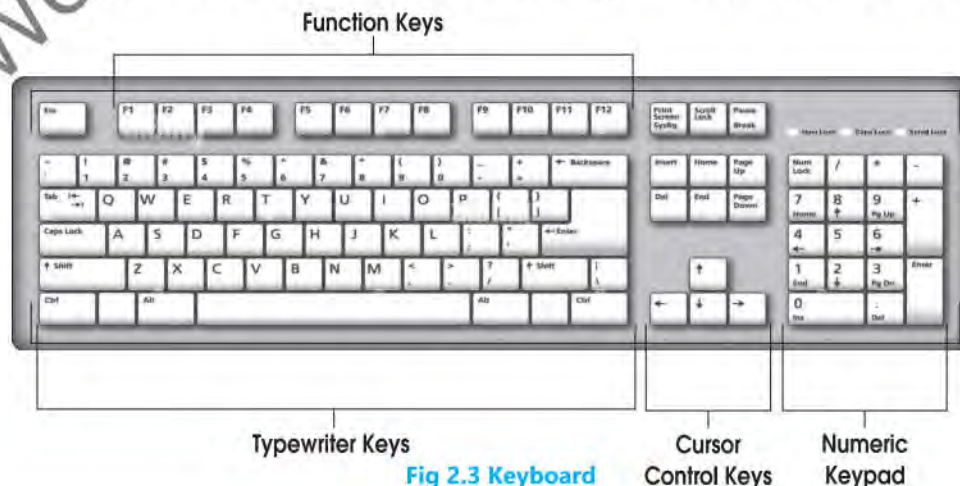


Fig 2.3 Keyboard

2.2.2 Mouse

Mouse is the most popular pointing device. It is a cursor-control device having a small palm size box with a laser beam at its base, which senses the movement of the mouse and sends corresponding signals to the CPU when the mouse buttons are pressed.

Generally, it has three buttons called the left, right and scroll buttons. A mouse can be used to control the position of the cursor on the screen.



Fig 2.4 Mouse

2.2.3 Joy Stick

Joystick is also a pointing device. It is used to move the cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The joystick can be moved in all four directions.

It is mainly used in playing games.



Fig 2.5 Joy stick

2.2.4 Light Pen

Light Pen is a pointing device similar to a pen. It is used to select a menu item or draw pictures on the monitor screen. It consists of a photocell and an optical system placed in a small tube. When the tip of a light pen is moved over the monitor screen and the pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.



Fig 2.6 Light pen

2.2.5 Scanner

Scanner is an input device, which works like a photocopy machine. It is used when some information is available on paper and it is to be transferred in the computer for further manipulation.

Scanner captures images from the paper and converts them into a digital form that can be stored in computer. These images can be edited before they are printed.



Fig 2.7 Scanner

Do you Know?

Printed copy is also called Hardcopy and electronic version is called softcopy.

2.2.6 Microphone

Microphone is an input device used to input sound in computer. This sound is stored in a digital form in computer. The microphone is used for various applications such as adding sound to a multimedia presentation and recording in computer.



Fig 2.8 Microphone

Do you Know?

Microphone is also called Mic.



Fig 2.9 ORC

2.2.7 Optical Character Reader (OCR)

OCR is an input device which is used to read text from hardcopy to make it editable. OCR scans the text optically character by character, converts them into a machine readable code, and stores the text on the system memory. User can add, remove or edit the text.

2.2.8 Bar Code Reader

Bar Code Reader is an input device used for reading bar coded data. Bar coded data is generally used in labeling goods etc. We can see Bar Code Readers in shopping Malls these days. Bar Code Reader scans a bar code image, converts it into an alphanumeric value, and sends this value to the computer.



Fig 2.10 Barcode reader

2.3 Sensors

Sensors are input devices that record data about the physical environment around them. Sensors send data to a computer. They do not make judgments, decisions or control any output devices. There are different sensors available each designed to measure different physical properties. Some of these sensors are below:

- Magnetic Field Sensor
- Motion Detector Sensor
- Sound Sensor
- Humidity Sensor
- Pressure Sensor
- Light Sensor

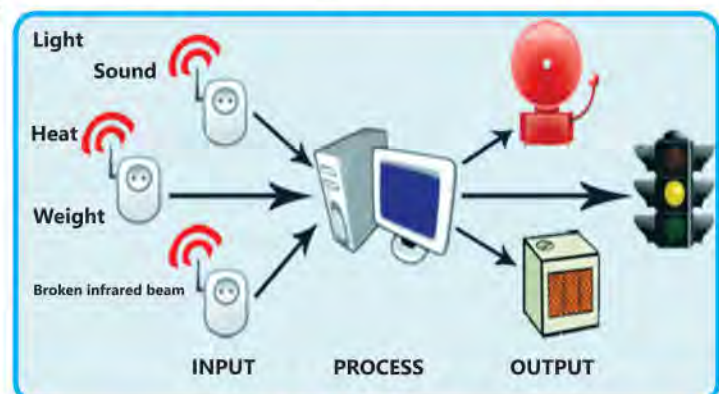


Fig 2.11 Sensors

2.4 Output Devices

Output devices are hardware devices used to show the result of processing in human presentable form. Usually, most output devices are made for human use, so they receive the processed data from the computer and transform it in the form of audio, video, or physical reproductions. There are various output devices connected to the computer. The most basic of which is a monitor. Whatever we write using a keyboard or click using a mouse, is all displayed on the monitor.

When we visit an ATM, we enter our details like language, pin, amount to be withdrawn, etc. and then the final money which the cash dispenser releases is our outcome. In this case, the cash dispenser acts as an output unit. Some of output devices are:

- Monitors
- Graphic Plotter
- Printer
- Speaker

2.4.1 Monitors

A Monitor is an output device that is also known as a Video Display Terminal (VDT) or a Video Display Unit (VDU). It displays images, text, video, and graphics information generated by a connected system unit. It is like a TV but its resolution is higher than a TV. The first computer monitor was introduced in 1973. Old monitors used a cathode-ray tube (CRT) and some plasma displays while modern monitors use thin-film-transistor (TFT) or Liquid-Crystal Display (LCD) for display.

There are three kinds of monitors:

- Cathode-Ray Tube (CRT)
- Flat-Panel Display
- SMD LED Screen

Cathode-Ray Tube (CRT) Monitor

The CRT is a type of vacuum tube which displays images when the electron beams emitted by electron guns strike on the phosphorescent surface. In other Words, the CRT generates the beams, accelerates it at high velocity and deflects it for creating the images on the phosphorous screen so that the beam becomes visible.



Fig 2.12 Output Devices

MONITOR? TYPES OF MONITOR



Fig 2.13 Output Devices

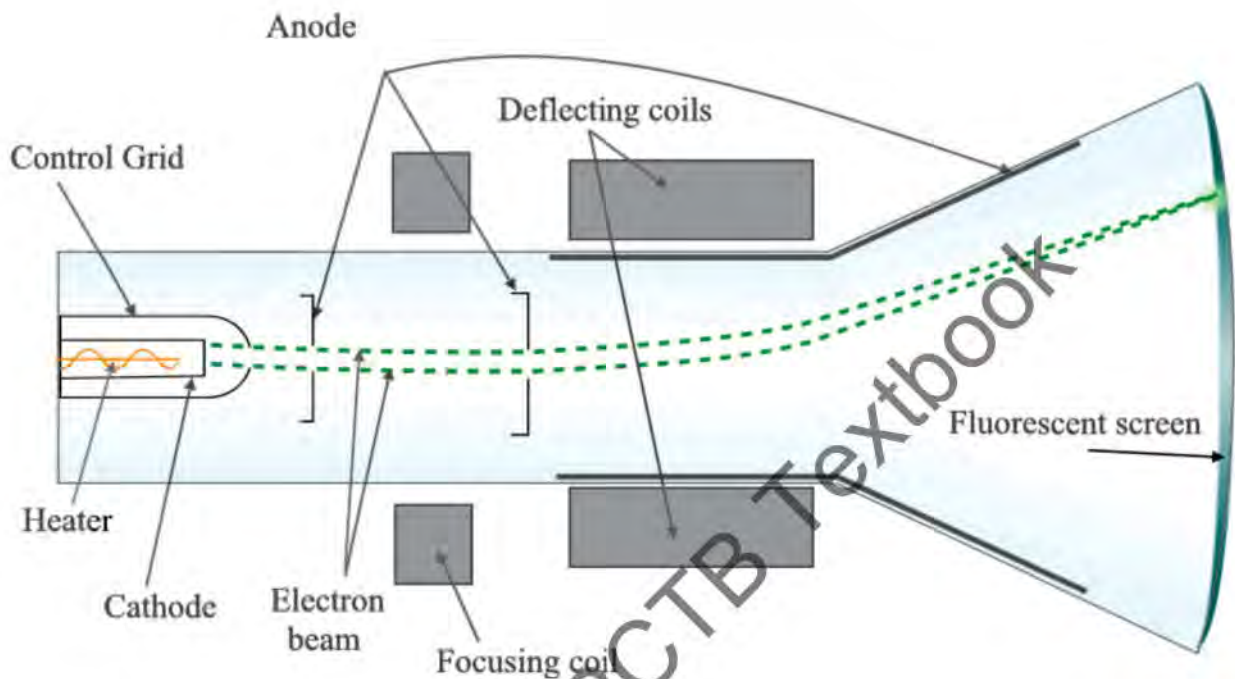


Fig 2.14 Cathode Ray Tube

Flat-Panel Display

A flat panel display is a television, monitor or other display unit that use a thin panel design instead of a traditional Cathode Ray Tube (CRT). These screens are much lighter and thinner, and can be much more portable than traditional televisions and monitors. They also have higher resolution than older models. Flat Panel Display is generally divided in to two types:

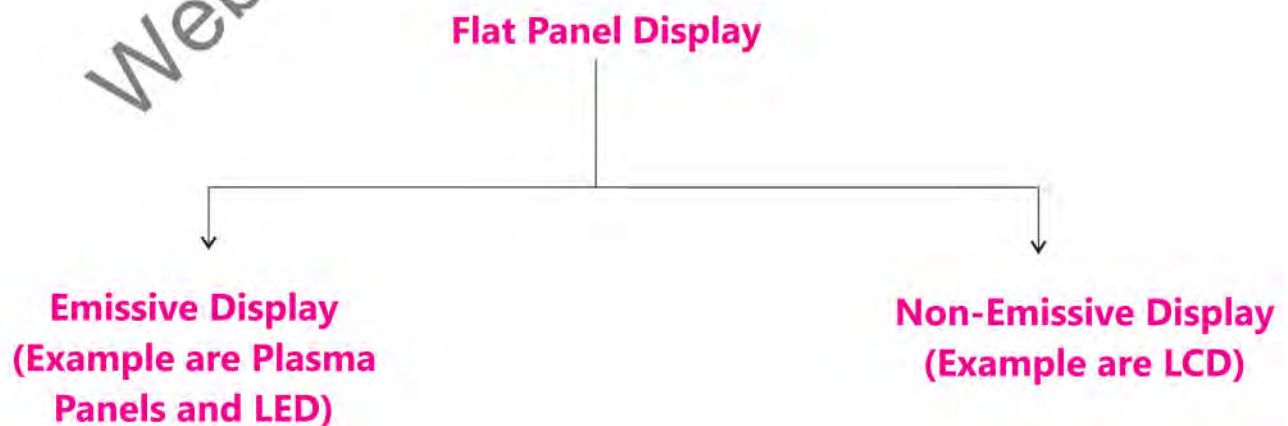




Fig 2.15 SMD Display

SMD LED Screen

The term "SMD" stands for Surface Mounted Device. It refers to the mounting method used in manufacturing electronic devices such as LEDs. Unlike traditional display devices SMDs are mounted on printed circuit boards using automated equipment.

2.4.2 Multimedia Projector

A multimedia projector is a high resolution, full-color projector capable of projecting text, images, video and audio content. Multimedia projectors are used in classrooms and offices for presentations. Multimedia projectors are also referred to as data projectors. Multimedia projectors are capable of several display resolutions, including 800 x 600 pixels, 1024 x 768 pixels (XGA), 1280 x 720 pixels (720p), and 1920 x 1080 pixels.



Fig 2.16 Multimedia Projector



Fig 2.17 Plotters

2.4.3 Graphic Plotter

A plotter is a device much like a printer that is used for printing vector graphics. Instead of toner, plotters use a pen, pencil and marker to draw multiple, continuous lines on paper. Plotter was widely used for computer-aided design, but now these devices are replaced by wide-format printers.

2.4.4 Printer

A printer is an output device that prints on paper. Printers print text documents, images, or a combination of both. The two most common types of printers are inkjet and laser printers. Laser printers are a typical choice for businesses as well as for individuals.

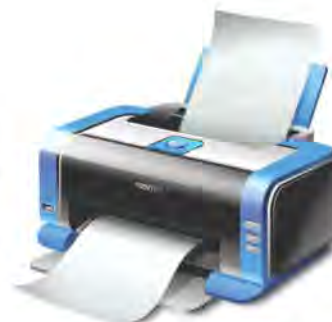


Fig 2.18 Printer

Extra Bit!

Vector graphics are computer images created using a sequence of commands or mathematical statements that place lines and shapes in a two-dimensional or three-dimensional space.



Fig 2.19 Speaker

2.4.5 Speaker

Speaker is an output device that connects to a computer to generate sound. The signal used to produce the sound that comes from a computer speaker is created by the computer's sound card.

2.5 Central Processing Unit (CPU)

The Central Processing Unit is the core of any computer system. It comprises of three major components which have been discussed below:

- Memory Unit
- Control Unit
- Arithmetic and Logical Unit

All these three units are elements of CPU and together help in the working and processing of data. It is also known as the "Brain of Computer" and no action can be taken by a system without the execution and permission of the Central Processing Unit. Main components of CPU are discussed below:

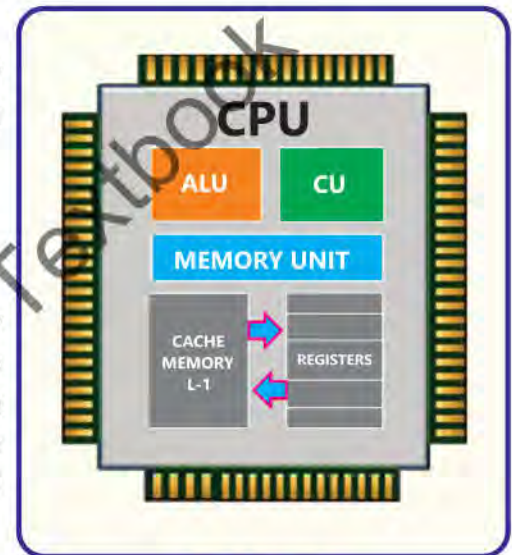


Fig 2.20 CPU

2.5.1 Memory Unit

Memory is basically a device that has the capacity to store information. A memory unit refers the amount of data that the memory can hold. We measure this storage capacity in terms of bytes. There are two basic types of computer memory which are:

- Primary memory
- Secondary memory/storage

Units of Memory

The storage capacity of the memory is expressed in various units of memory Bit represents '0' or '1' in memory which is its basic unit. These are given in table 1.1.

Primary memory

Primary memory is also known as main memory. It is also referred as "Internal memory." Processor directly accesses the primary memory using data bus. Primary memory allows a processor to access programs and data stored in memory locations. It has limited capacity and it is expensive. Examples of Primary memory are RAM and ROM.

"RAM" stands for "Random Access Memory". It is also referred as short-term memory. It's called "random" because processor can or store data randomly at any physical location. It is a temporary storage memory. RAM is also called volatile memory because data in RAM is vanished when power is lost. RAM stores the currently processed data from the CPU and sends them to the other units.

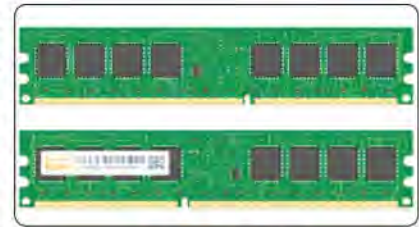


Fig 2.21 RAM

"ROM" stands for Read Only Memory. It is the long-term internal memory. ROM is "Non-Volatile Memory" because data stored in ROM retains even if power is lost. Like RAM CPU directly accesses ROM. It comes with pre-written programs by the computer manufacturers. It holds the instructions for booting-up the computer.

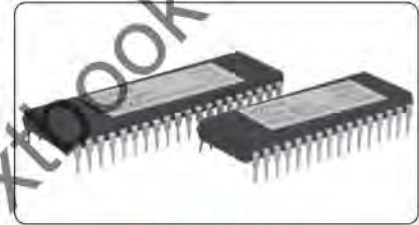


Fig 2.22 ROM

Computer Memory Measurement Units

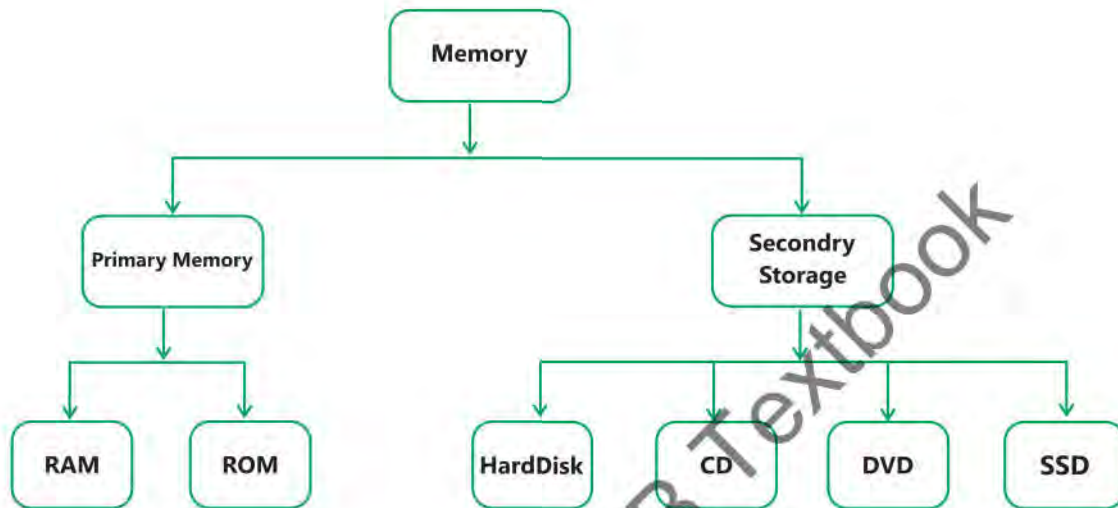
SYMBOL	FULL FORM	QUANTITY
1 BIT	BINARY DIGIT	1 CELL , BINARY 0 OR 1
4 BITS	NIBBLE	1/2 BYTE
8 BITS	BYTE	1 BYTE
1024 BYTE	KILOBYTE	1 KILOBYTE
1024 KILOBYTE	MEGABYTE	1 MEGABYTE
1024 MEGABYTE	GIGABYTE	1 GIGABYTE
1024 GIGABYTE	TERABYTE	1 TERABYTE
1024 TERABYTE	PETABYTE	1 PETABYTE
1024 PETABYTE	HEXABYTE	1 HEXABYTE
1024 HEXABYTE	ZEETABYTE	1 ZEETABYTE

2.5.2 Secondary Storage

We need some devices to store the data permanently in computer, so we use some external storage devices for this purpose which we name as the secondary storage.

As we have read, that primary memory is expensive as well as limited. We need cheaper and permanent memory to store large amount of data permanently. Such memory is called secondary memory. It is also called external memory. It is different from primary memory because it is not directly accessible to CPU. It has larger storage capacity as compared to primary memory. It is non-volatile therefore data stored in secondary memory retains if

power is lost. Commonly used examples of secondary storage are Hard Disk, SSD and USB drive.



Hard Disk Drive

Hard disk drive is a secondary storage device used to store data permanently. It is non-volatile storage device which means it will retain data when computer is turned off. It is also known as hard drive. It is electro mechanical storage device which stores or retrieves data on coated magnetic plates. A read/write head charges the disk's surface with positive or negative charges, this is how binary 1 or 0 is represented. Typically hard disk drive capacities are measured in Terabytes (TB).



Fig 2.23 Hard Disk

Applications of Hard Disk Drives

Hard Disk Drives are used in:

- Desktop computers
- Laptop computers
- TV and satellite recorders
- Servers
- Mainframes

Advantages of Hard Disk Drives

- Large capacity
- Faster than optical disks like DVD'S
- Persistent storage
- Easily replaced and upgraded

Disadvantages of Hard Disk Drives

- Relies on moving parts
- Disk surface can be damaged
- Heavy power consumption
- Noisy
- Slower read and write speed than RAM

Solid State Drive (SSD)

Solid state drives are non-volatile storage devices capable of holding large amounts of data. It is new generation of storage devices. SSD uses flash based memory which is much faster than traditional Hard Disk. SSD has increased the speed of computer systems because it can access data rapidly as compared to magnetic plates. SSD is connected to a computer using standard IDE or SATA connections.

Applications of SSD

SSD is used in:

- Smartphones
- Tablet computers
- latest laptops
- Two drive desktop solutions
- HD video cameras

Advantages of SSD

- High speed
- More durable
- More compact
- Less noise
- Low Power consumption

Disadvantages of SSD

- Expensive
- Less storage space than HDD
- Limited Life span
- Data Recovery is near to impossible



Fig 2.24 SSD

USB Flash Memory

USB is also non-volatile solid state storage devices. It is Plug and Play device which means we don't need drivers to run a USB device. Its storage capacity is up to 1 TB.

Applications of flash memory

- USB memory sticks – saving and transferring documents etc.
- Memory cards in digital cameras

Advantages of USB Drive

- Cost effective
- High speed
- Suitable size
- Less noise
- Plug and play

Disadvantages of USB Drive

- Source of spreading malware
- Limited life span
- Security threats
- Risk of losing



Fig 2.25 USB

2.5.3 Control Unit (CU)

Control Unit (CU) manages the entire functioning of the computer system. It is one of the most essential components of the computer system. The Control Unit collects the data entered using the input unit, leads it on for processing and once that is done, the output is presented to the user. It can be considered the center of all processing actions taking place inside a computer device.

Basically, the instructions taken, interpretation of entered data, issuing signals to execute the data and then finally retrieving the data is all done in the Control Unit.

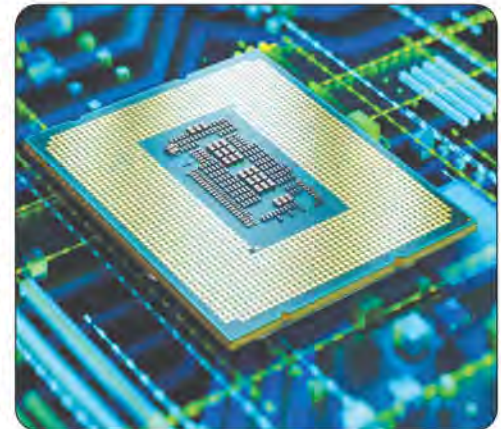


Fig 2.26 Control Unit (CU)

2.5.4 Arithmetic & Logical Unit

As the name suggests, all the mathematical operations are performed in the Arithmetic and Logical Unit of the CPU.

It can also perform actions like calculation a comparison of data and decision-making actions. The ALU consists of circuits using which addition, subtraction, multiplication, division, less than, greater than, equal to and other numerical based calculations can be performed.

2.6 Working of Computer System

Computer is an electronic machine which processes the data (input) to produce the desired information (output), and saves data (storage) according to the given instructions. A computer works by combining input, storage, processing, and output operations. All the main parts of a computer system are involved in these four operations.

Input: Input is the data before processing. It comes from input devices such as mouse, keyboard, microphone, and other external sensors.

Processing: In processing operation input is transformed into output. Central Processing Unit (CPU) is responsible for this operation.

Storage: The storage is how the computer saves input. Immediate processing is stored temporarily in the Random Access Memory (RAM) while hard drive is used for long-term storage.

Output: Output is the final result of data processing. You can also receive the output through a printer or a projector instead of directly through your monitor.

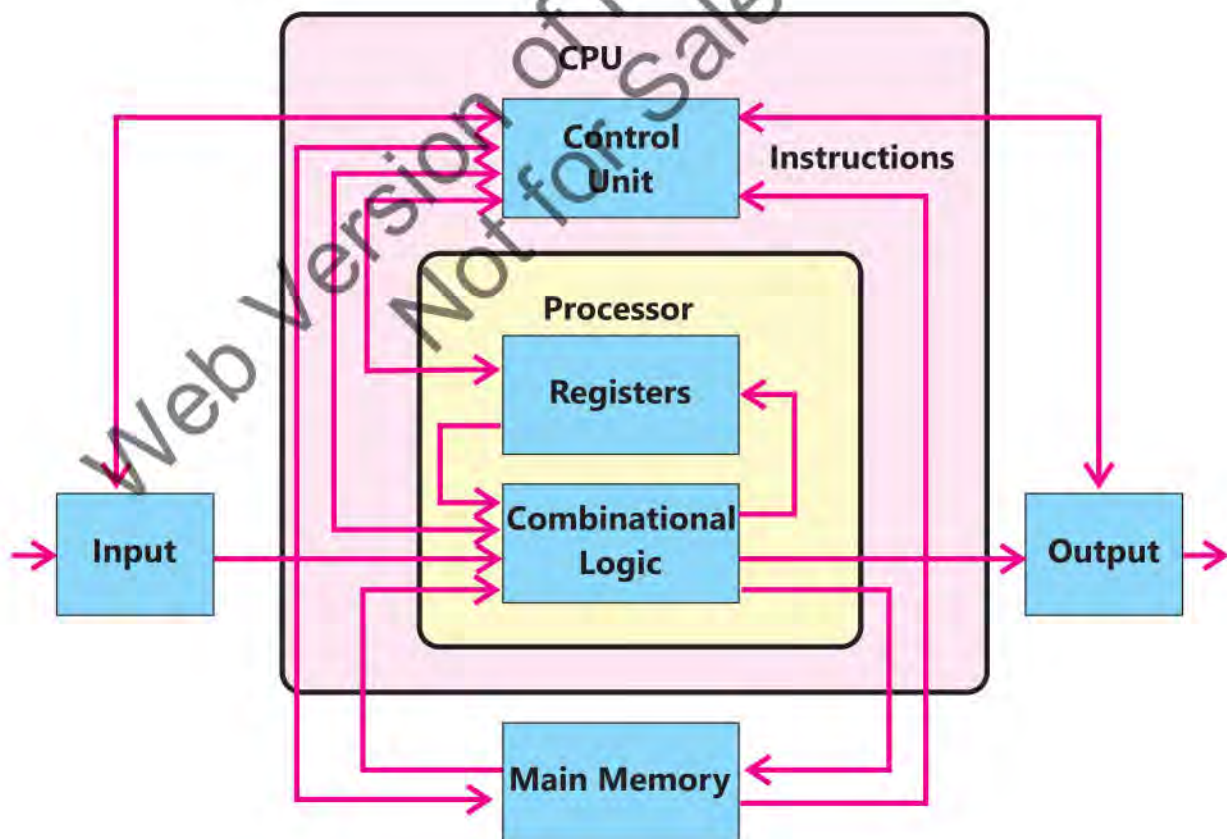


Fig 2.27 Working of CPU

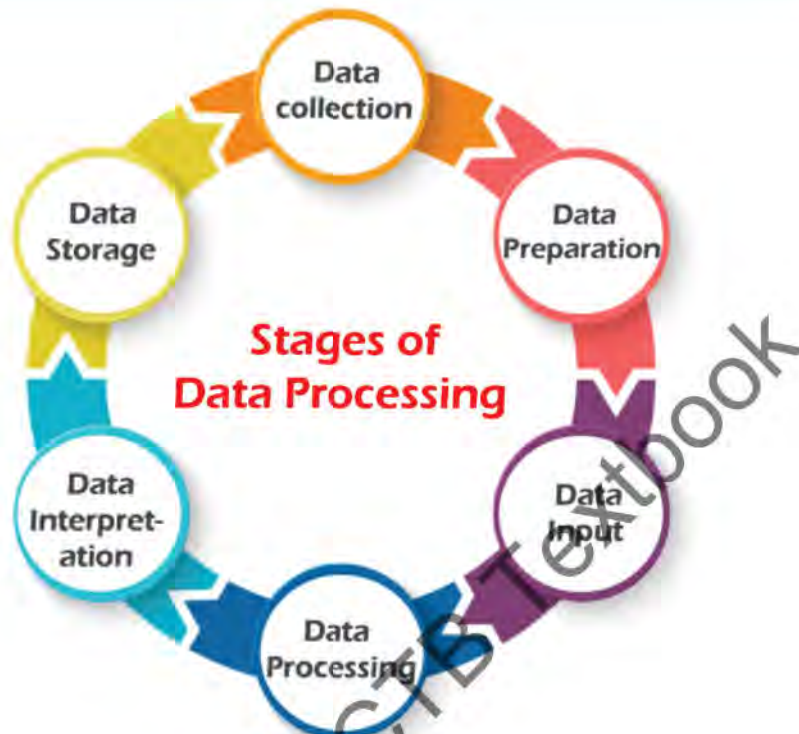


Fig 2.28 Stages of Data Processing

Summary

- Computer is composed of hardware and Software.
- Basic components of computer are input devices, output devices and central processing unit (CPU).
- Input devices are devices used to enter data in the computer.
- Output devices are used to show the results of processing.
- Sensors are input devices that record data about the physical environment around them.
- Monitors are output devices which are also known as VDU or VDT.
- Printer prints on paper which is also called hardcopy.
- All operations of computer are performed by CPU which is also called brain of computer.
- Arithmetic and Logic Unit, Control Unit and Memory Unit are basic parts of a CPU.
- RAM is a volatile memory, it is temporary memory.
- ROM is nonvolatile memory, it is permanent memory.
- Hard disk drive is a secondary storage device used to store data permanently.
- Solid state drives are non-volatile storage devices capable of holding large amounts of data. It is new generation of storage devices.
- USB is also non-volatile solid state storage devices. It is Plug and Play device which means we don't need drivers to run a USB device.



Exercise

Tick (✓) the Correct option:

1. Which of the following is not an input device:
a. keyboard b. speaker c. mouse d. scanner
2. In light pen the sensing element is called:
a. photocell b. cell c. light cell d. none
3. Input device which is used to transfer hardcopy into a computer is called:
a. mouse b. joystick c. scanner d. keyboard
4. The device that is used to input sound in the computer is known as:
a. joystick b. speaker c. light pen d. microphone
5. OCR stands for
a. optical Correct Reading c. optimal Copy Reading
b. optical Character Reader d. optical Character Reading
6. Which of following is/are type of sensor:
a. Sound sensor b. pressure sensor c. Light sensor d. all
7. Devices that are used to display the result of processing are called:
a. output devices b. input devices
c. storage devices d. processing devices
8. Which of following is/ are type of monitor:
a. LCD b. TFT c. SMD d. all
9. Which of following is/are not part of CPU
a. AU b. MU c. PU d. CU
10. All mathematical operations in computer are performed by:
a. memory unit b. control unit
c. arithmetic unit d. storage unit

Briefly answer the following questions:

1. What are input devices? Enlist any four.
2. Write a short note on keyboard.
3. Differentiate between mouse and joystick.
4. How does a light pen work?
5. Write a note on monitors, enlist its types.

6. Differentiate between Flat panel and SMD monitors.
7. Differentiate between primary memory and secondary storage.
8. Differentiate between RAM and ROM.
9. How SSD is better from HDD?
10. Write the function of control unit in computer system.

Answer the following questions in detail:

1. What is scanner? Why do we use it?
2. How does a barcode reader work?
3. What are sensors? Where do we use them?
4. Write a note on CPU, discuss working of its different parts.
5. Can a computer work without secondary storage devices? Justify your answer.
6. How does a computer work? Write down steps needed to convert data into information.

Write the functions of following:

ROM, RAM, ALU, CU, HDD, SSD

Activity Based Question

1. Ask the students to work in groups and write down their thoughts about it. Tell the students that there are many inputs and outputs on the smartphones they must have used or seen. If the students struggle here, consider asking them the following prompts:
 - o "How does the phone know it has to shut down when it is too hot?"
 - o "How does the phone know its location?"
 - o "How does the phone know when to switch from playing music through the speakers to playing music through the headphones?"
 - o "How does the phone know when to turn off the screen when you put the phone up to your ear?"

After completing that, ask the students to present their collective thoughts as a group to the class.

Digital Skills

Students Learning Outcomes

After completing this unit students will be able to:

- Define the term operating system
 - Demonstrating the startup procedure of any available operating system
- Differentiate between the types of operating system (windows, MAC, Linux, and Android)
- Analyze the functions of operating systems
 - Identifying the desktop icon/tools (desktop, start button, start menu, taskbar, notification area, desktop icon) and explaining their functions.
- List the function of files, folders, shortcuts and a drive (with Example)
 - Demonstrating how to create, name, rename and delete a new file, folder and create a shortcut.
 - Demonstrating how to cut, copy, and paste a file/folder to another folder/location, drag and drop a file/folder to another folder/location.

3.1 Software

Computers are electronic devices that are built out of hardware, physical devices which are used to enter, process, store and receive information. In order to manage and control these devices software is used.

Software is defined as a set of instructions, data and programs that are used to operate computer and perform a specific task.

3.1.1 Types of Software

There are two main types of software:

- **System software:** these refer to the set of useful programs that can be found on every computer. One of the most important system software is Operating system. System Software is a type of program that is designed to control and manage the computer's internal and external resources. If we think of computer as a layered model, the system software is considered as a primary interface between the hardware and user applications.
- **Application Software:** these refer to programs written to carry out a certain task of the user such as writing text (Microsoft Word), making spreadsheets (Microsoft Excel), editing image (Microsoft Paint) and browsing internet (Internet Explorer). Some application software is especially designed to meet the targeted demands of managing systems at school and medical centers.

The core purpose of the system software:

- Simplify the use and the interaction of the hardware and software.
- Provide an aid in controlling the hardware and software of the computer.
- Optimizes the effectiveness and performance of the computer.

Types of Software

There are four basic types of system software:

- Operating system
- Device Driver
- Utility Program
- Language Translator

3.2 Operating System

The operating system is a system software that controls and manages all operations of the computer. Computers do not function without an operating system subsequently. It is the job of an operating system to make sure that the necessary operations of the computer hardware and software are working properly.

Functions of Operating system

Some of the main functions of an operating system are to do the following:

Booting Process:

Completes its own loading into the main storage once the computer starts.

Security Management:

Manages the security of the user accounts.

Application Management:

Enables the user to install and use the application programs on the computer.

Memory Management:

Organizes the use of memory and processing time between user and programs.

File Management:

Enables the user to save, load, delete rename, print and copy files.

Device Management:

Controls the use of peripherals such as disk drivers and printers.

Coordination between Software and User:

Provide an interface between the user and the computer software and hardware.

Some of the most common operating systems are Android, MacOS, MacDOS, Chrome OS, Blackberry, Solaris, Linux and Microsoft Windows (like Windows 10, 8, 7, Vista, XP etc.)



Fig 3.1 Operating systems

Types of Operating Systems

Windows

Windows is a graphical operating system developed by Microsoft. This operating system allows you to use the computer. It is for personal computers, work station and embedded systems.



Mac

Mac OS is the computer operating software used by Apple desktop and laptops. Mac OS was introduced in 1984 to run Macintosh Personal computers.

Linux

Linux is a Unix-like, community-developed and open-source operating system (OS) for computers, servers, mainframes, mobile devices and embedded devices. It is supported on almost every major computer platform, including x86, ARM and SPARC, making it one of the most widely supported operating systems.



Android

Android is a mobile operating system which is categorized as an open-source software. It is developed by google that creates and shares its own version of it and is based upon the Linux Kernel and GNU software. Its target system type is tablet computers and smart phones.

Do you Know?

Differentiation of types of operating system.

Name of OS	Latest stable version	Latest release Date
Android	Android 12L	March 2022
Linux	5.19	July 2022
Mac	IOS 15.6.1	August 2022
Windows	Windows 11	August 2022

3.3 Device Drivers

Device Drivers enable the computer hardware components to communicate with the computer. e.g. printer driver and sound drivers.

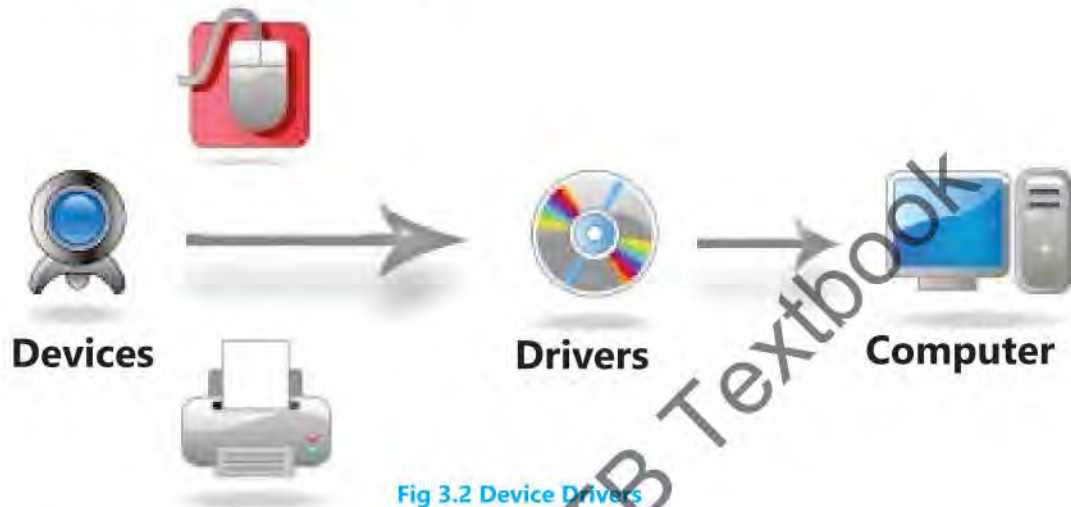


Fig 3.2 Device Drivers

3.4 Utility Programs

It is also known as Service program. A utility program is an application that performs management tasks related to the functions of the computer. There are several types of utility software which are as follow:

- Antivirus
- File management tools
- Compression tools
- Disk cleanup tool
- Disk Management tools.
- Backup utility



Fig 3.3 Utility Programs

3.5 Language Translator

These are the software that are used to translate computer program from human readable language to machine understandable code language.

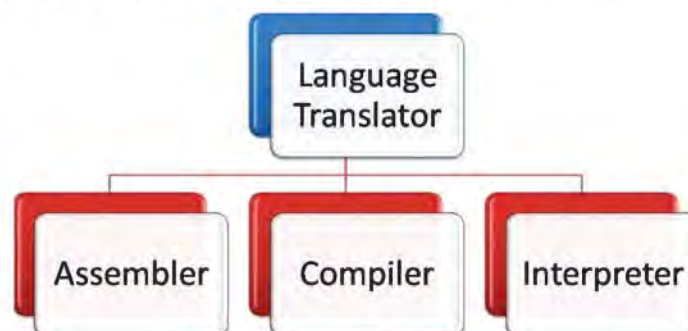


Fig 3.4 Language translators

3.6 Stepping into Windows

3.6.1 Startup procedure of Windows

1. Press power button available on system unit, login screen will appear
2. Click the user name and write password in password field.
3. Press Enter button or click on login button

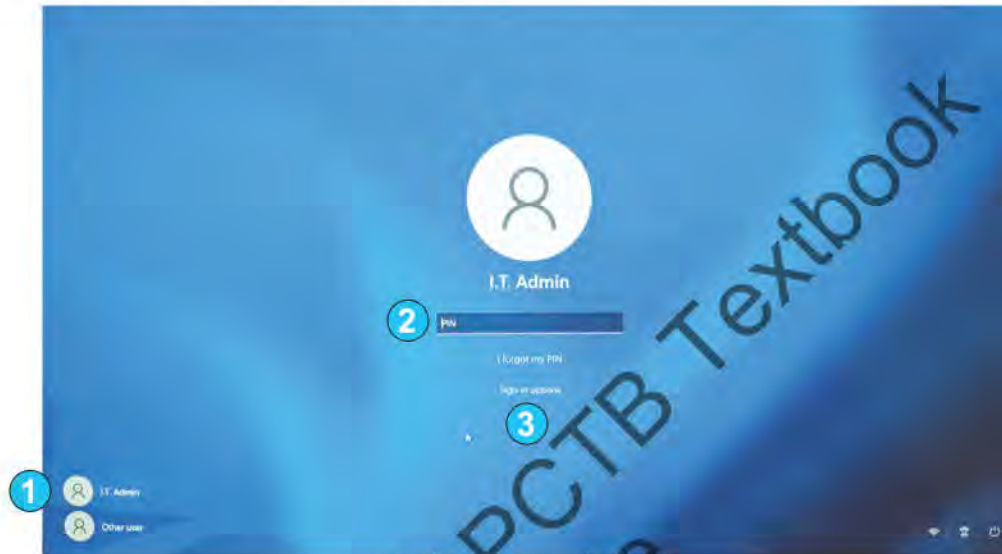


Fig 3.5 Startup Procedure

3.6.2 Exploring Microsoft Windows

After starting the computer, the desktop is the first and the main screen that the user will see. The desktop layout is shown in the illustration below:

The desktop consists of the following parts:

- Icons: These are small pictures that can open a file, folder or program.
- Taskbar: It is a long bar found usually at the bottom of the desktop
- Background: This is a large area of the desktop where all the programs are opened

File Explorer is a file manager application that allows to access files and folders on the computer.

Taskbar Programs provide quick access to the opened programs



We can also change the background picture of our own choice. The background is often called a wallpaper.

We can change the background by following the steps below:

- Right click anywhere on the desktop: this will open a menu.
- Choose "personalize" from the menu. We can find many important things on the screen.
- Click on desktop background, select the image for background.

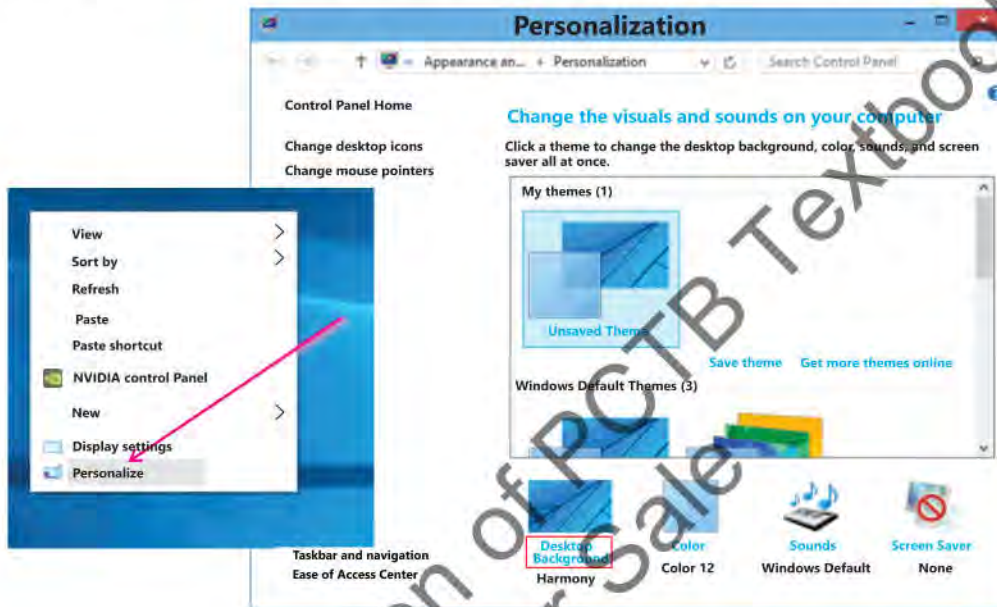


Fig 3.6 Desktop Background

Start button

When we click on the start button, the start screen will open. From the start screen, we can open programs found on our computer.



Fig 3.7 Taskbar programs

Program buttons

The area on the taskbar with several program button has icons of the programs that we often use when we are currently running the program. We can simply open the program by clicking on its icons button on the taskbar.

Notification area

The notification area is found on the right side of the taskbar. It shows the date and time as well as the icons that show information about some programs like battery, WIFI, volume, Calendar and action center.

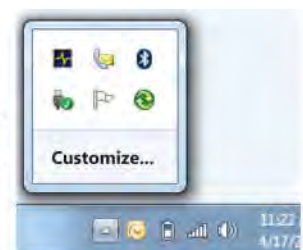


Fig 3.8 Notification Area

Show desktop button

The show desktop button is found on the far-right of the taskbar. If we click the Show Desktop button, all open windows will hide and we can then see the desktop.

3.6.3 Snipping tool

Snipping tools are used to take the screen shots of a specified area on screen. To open this built-in snipping tool on Window 10 and 11, press the Windows + shift + S

For the keyboard shortcut.

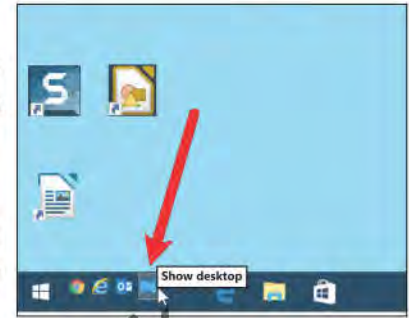


Fig 3.9 Desktop Buttons

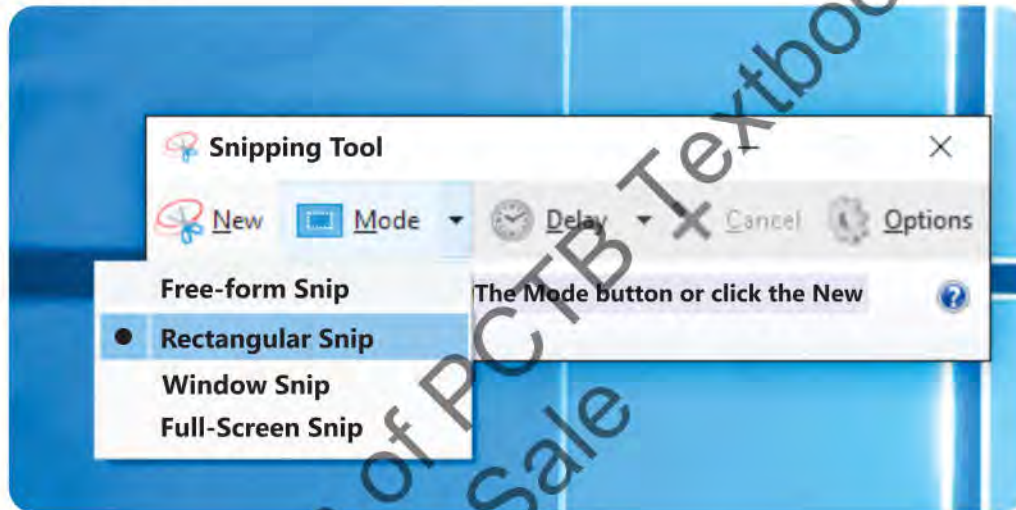


Fig 3.10 Sniping Tool

3.6.4 Microsoft Windows Store

Microsoft Windows Store is a digital distribution platform that has nearly everything for your device. It provides different types of application free of cost or on payment.



Fig 3.11 Microsoft Windows Store

3.6.5 Working with Active Window

Active Window is said to be the currently used program that is opened in front of all the windows on the desktop. The important commands on the top right of the title bar on the window are as follows:

Close: This button allows to close the active window.

Maximize: This allows to enlarge/ fill the entire desktop screen or restore.

Minimize: This button hides the active window from view. Minimizing the window will create a button for it on the taskbar.



Tips:
You can search for a file in the start search by typing * in search box with the file extension to the file if you have forgotten the name of the file.

Fig 3.12 Active windows on Desktop

3.7 Managing Files and Folders

3.7.1 File

The core function of the computer is to sort and organize the information and data. A file can be defined as a common storage unit on the computer. This stored information can be a text, photo, audio, video, document or a presentation.



Fig 3.13 File



Fig 3.14 Folder

3.7.2 Folder

A folder (directory) is a collection of files in order to organize them on a storage device. This is a virtual place for documents, applications and data. A folder can also have other folders in it as its sub folders. These folders can be moved, retrieved and manipulated as one entity.

3.7.3 Shortcut

Shortcut is a link to the file created to easily access it. Shortcuts can be created on the desktop and in other folders. Clicking on the shortcuts takes the user to the original file.



Fig 3.15 Folder shortcut

3.7.4 Creating a new file

We can create a new file anywhere in the computer. This needs to be done in simple steps that are as follow:

Step 1: Navigate to the location or the folder in the computer where you plan to create your file. This can be on the desktop or any file in the folders.

Step 2:

Right click on any empty space in that folder.

Step 3:

Upon Right clicking a menu will open in place. Select "New" from the popped-up menu,

Step 4:

Select the type of file you want to created in that place.

Step 5:

We can name the new create file by simply clicking on the file.

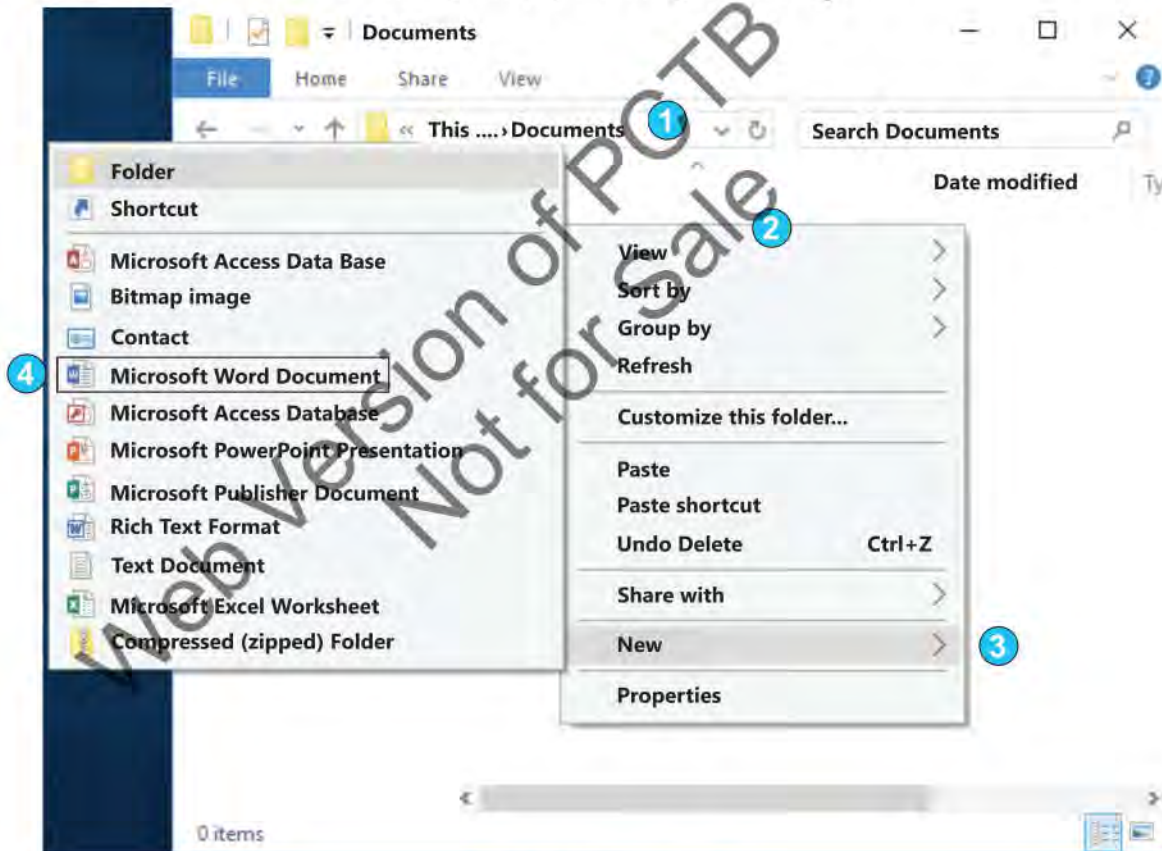
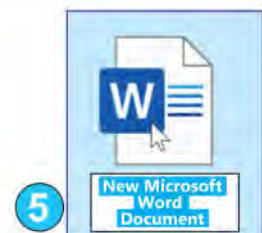


Fig 3.16 Creating New file

Step 6:

Once the file is created, you can double click on the icon to open it.

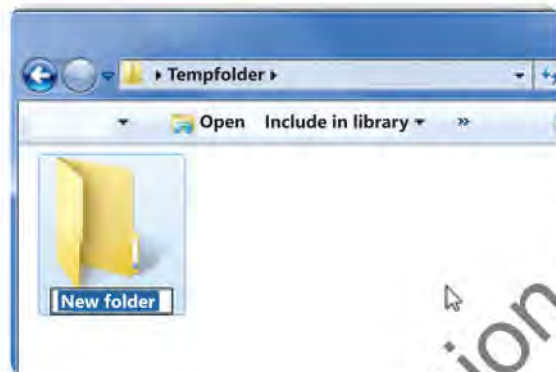
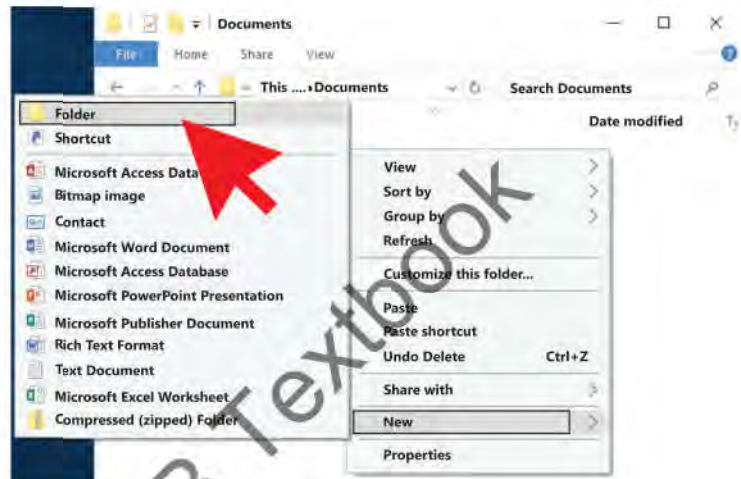


3.7.5 Creating new folder

To create a folder is almost the same as creating a file. The following are the simple steps to create a new folder:

Step 1:

In the location where you want to create a folder, select the option of the folder to create the folder.

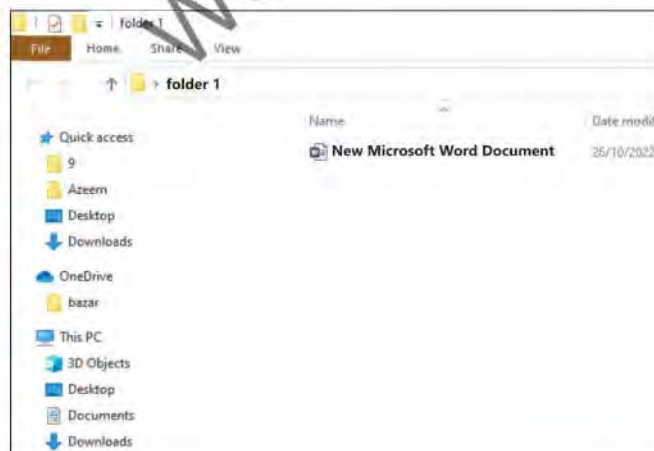
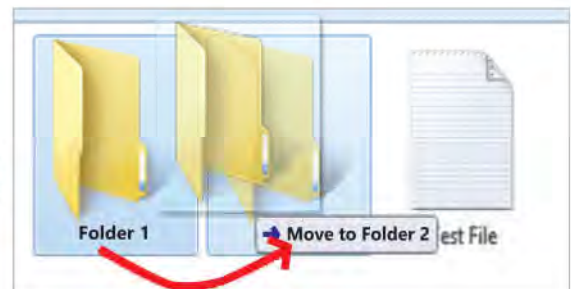


Step 2:

After a new folder appears, click on it to name.

Step 3:

You can drag the file or folder into the folder by clicking the file by holding it with the help of the mouse.



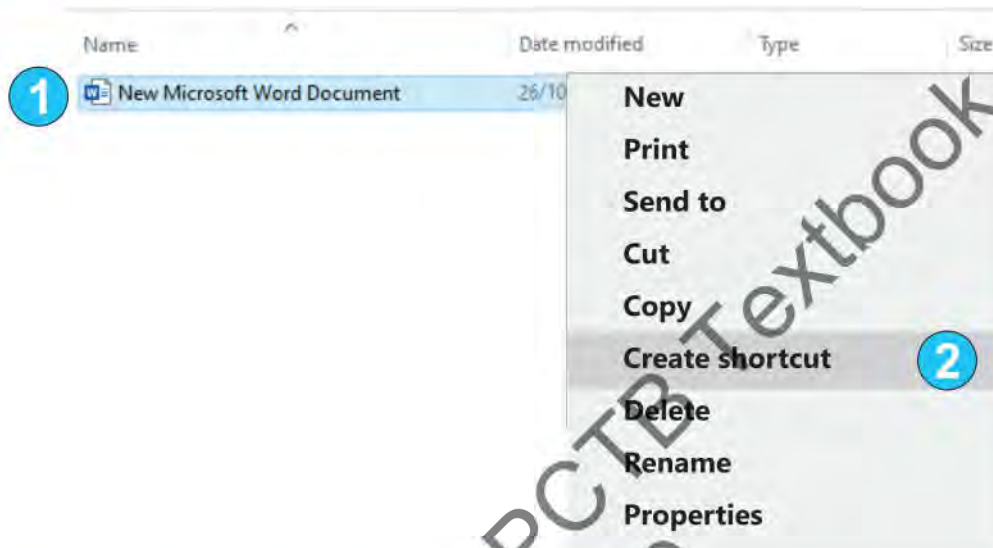
Step 4:

On double clicking the folder, you can view the file that are contained in that folder.

3.7.6 Create a shortcut

The following are the steps to create a shortcut of a file or a folder to the desktop:

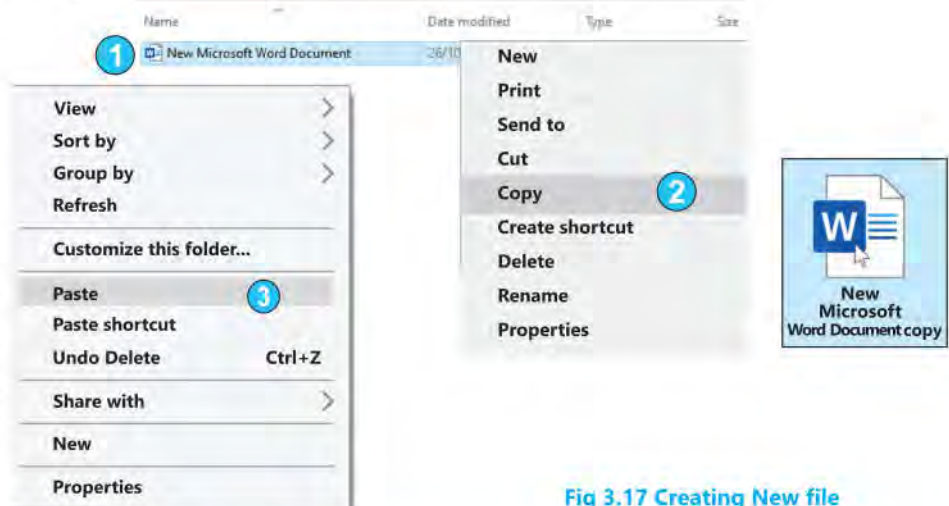
1. Right click on the folder or a file, a menu will pop up in place..
2. Select option "create shortcut" from the menu that extends.



3.7.7 Cut, Copy and Paste a file/ folder/ shortcut

There are three basic steps used to cut, copy and paste a file/ folder/ a shortcut.

1. Select the file/ folder that needs to be cut/ copy.
2. Right Click on the file / folder and select cut/ copy option from the menu that appears.
3. Right click on the location that you desire to paste the file/ folder and select 'paste' from the menu that appears

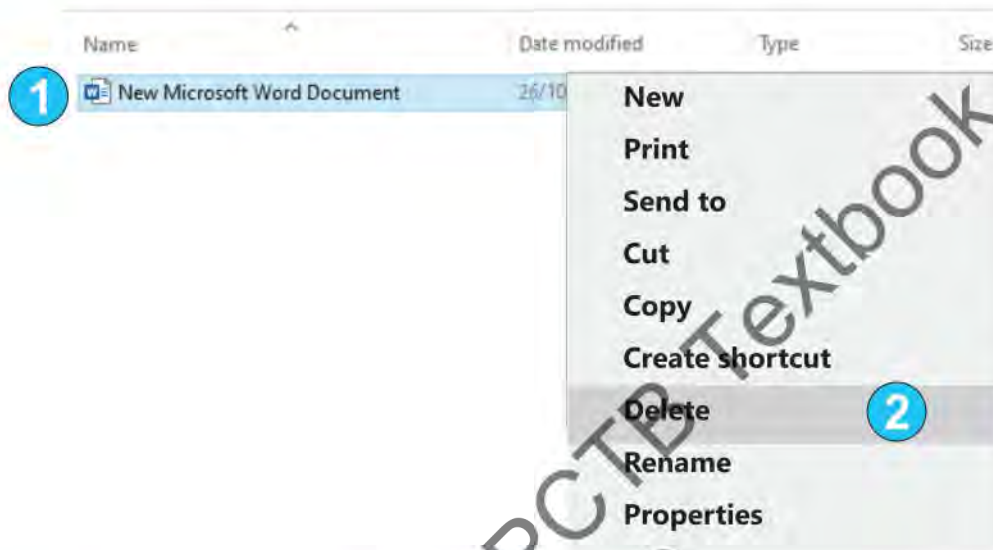


If you do not want a specific file or folder, you can delete it or remove it from your computer.

Fig 3.17 Creating New file

To Delete a file or folder:

1. Select the file and right click on file/folder.
 2. In the appearing option, select the delete option.
- Deleted file or folder is now in recycle bin.



3.7.9 Restore a deleted file/ folder/ a shortcut

To restore means to bring back something or to return to the former situation. Restoring a file subsequently means to bring back a file to its original place from the recycle bin where it was kept after deleting. The following are the basic steps to restore a file/ folder/a shortcut.

- 1- Double click the recycle bin icon on the desktop to open it.
- 2- Right click on the file that needs to be restored. Once the menu opens, click on the "restore" button option to put the file in its original location.

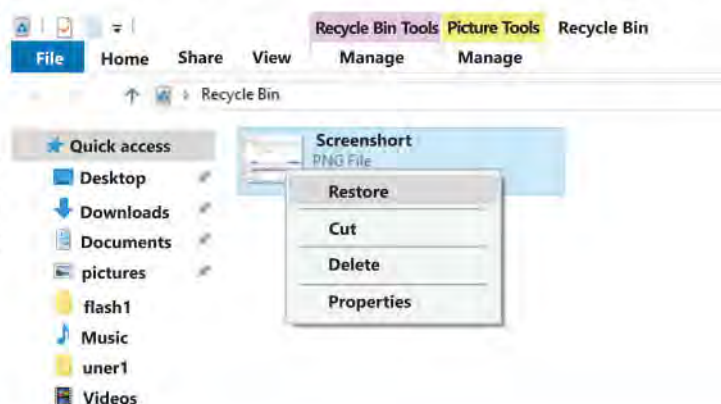
Alternatively, using the keyboard shortcut of Alt + del will delete the file completely and altogether from the computer. This means that once you use this shortcut the file will not be backed up in the recycle bin after you delete it rather it will be deleted directly.

3.8 Application Software

Software that is developed to aid the user to perform a specific task is known as application software. The different kinds of application software are: from your computer.

1. Entertainment Software:

This software is solely designed for the



sake of entertainment. These can include examples of video games, audio, music, animations and cartoons.

2. Productivity Software:

These are used to produce information in form of a text document. Spreadsheets, presentations, digital art and digital painting, etc.



Fig 3.18 Entertainment Software

3. Education and Reference Software:

These are primarily used to enhance and assist the learning skills. We use these software to seek assistance when we are making researches and developing on the educational grounds. Encyclopedia, dictionaries, educational games, Google maps, and tutorials are the perfect examples to such kind of software.



Fig 3.19 Productivity Software

3.9 Working with Paint 3D

Paint 3D is a raster graphics and a 3D creative application that is a refresh of Microsoft Paint. This application has numerous 2D and 3D tools that can work in collaboration to create fun and professional projects. This is an update of Microsoft paint that was initially released in 2017.

Some important features of Paint 3D are given below:



Fig 3.20 Educational Software

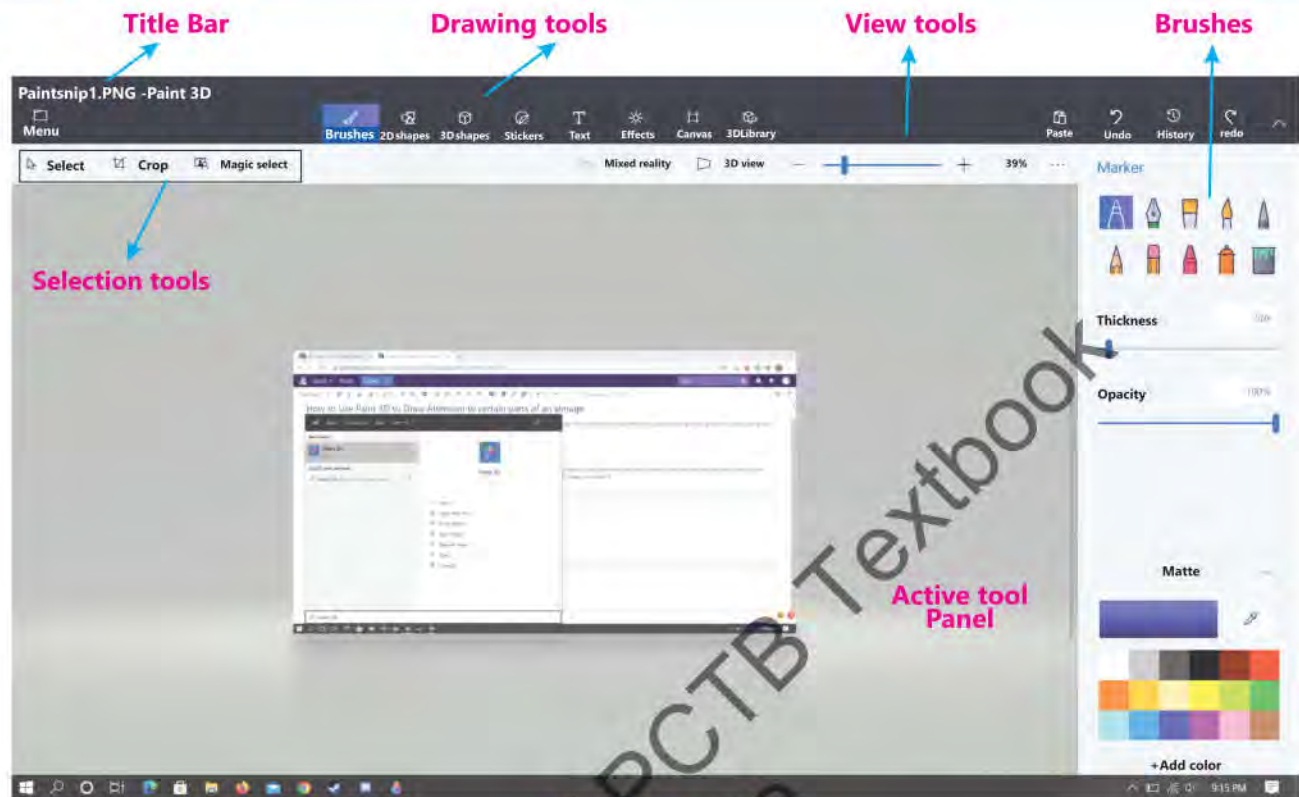


Fig 3.21 3D Paint

22

3.9.1 Brushes

- Hover the mouse over the Brush tool to display the name of the brush.
 - Select the brush by click on the option of your choice and start drawing lines by clicking on the left mouse button and dragging it from the starting point.
 - There are several brush sizes, colors and shapes to select from.
- From the Menu Select, you can save the project by clicking on the save option. Enter the name of the file and click save in the dialog box that appears.

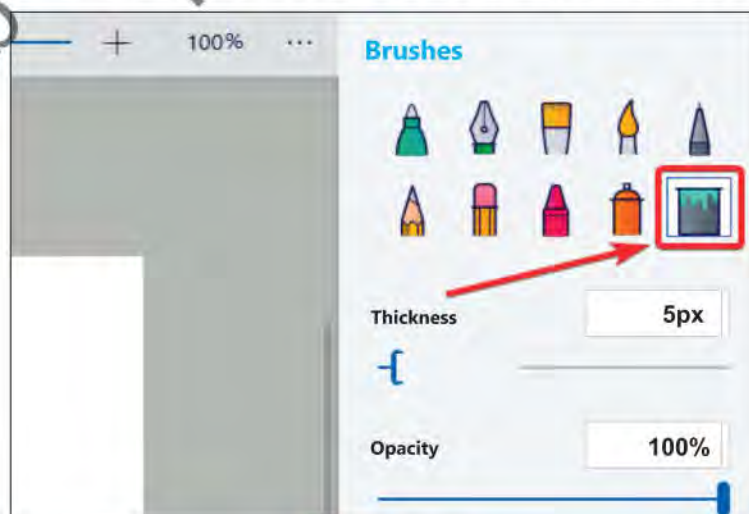


Fig 3.22 Brushes

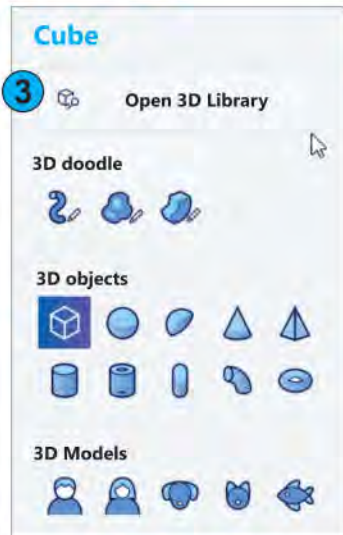


Fig 3.23 3D shapes

3.9.2 Creating 2D shapes

Following are the steps to create 2D shapes:

1. Select 2D shapes option from Toolbar.
2. After selecting the shape of your choice, drag it out into the drawing area.
3. Modify the shape by using the handles by the side of the shape to alter its size and shape.

3.9.3 Making 3D Image

1. Design a 2D image
2. Select the 3D mode to make the image 3 dimensional.
3. Rotate the object and size by using the handles on the side



Fig 3.24 Clone stamp tool

3.9.4 Clone Stamp tool

This tool is used to copy the images:

1. Drag the required shape in the drawing area.
2. Select the Stamp tool, the new shape appears.
3. After selecting different options, repeat this process for required number of shapes.

3.9.5 Drawing straight lines and drawing Multi point Curves

1. Select the 2D Shapes tool.
2. Select the straight-line tool.
3. Drag the mouse from the starting point to stretch a line of desired length in any direction.

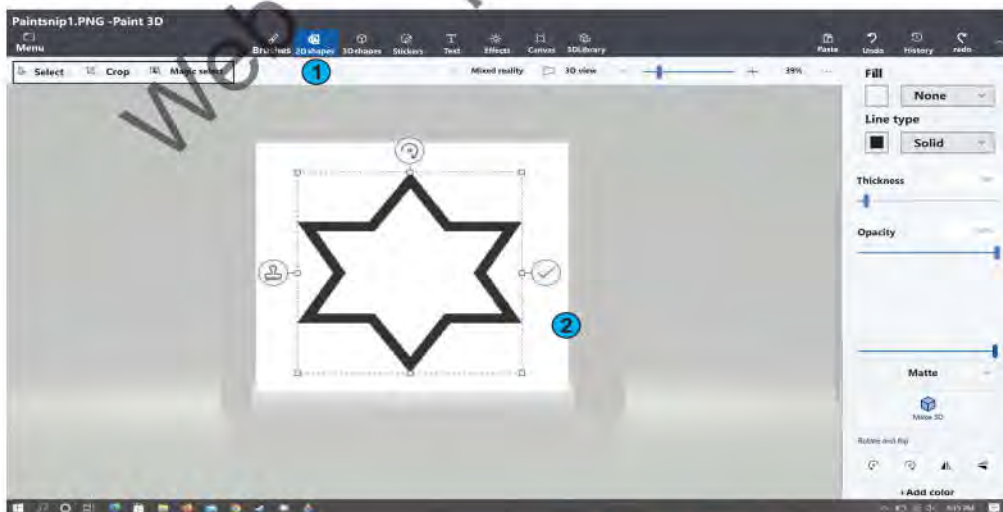
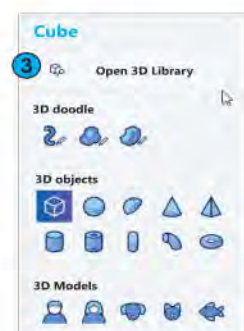


Fig 3.25 Line tool



4. Control the lines in any direction by selecting the corners or the midpoints.

3.10 Working with 3D models

3D (three dimensional) model is a technique in computer graphics that is vastly used to create real world objects in three axes to represent their height, length and width. These models give an illusion of moving in and out of the plane of canvas.

3.10.1 3D shapes

3D shapes in Geometry are defined as shapes with three dimensions such as Length, width and height.

3.10.2 Create 3D objects

Following are the steps to create a 3D shape:

1. Select 3D Shapes tool from Toolbar.
2. Select a cube object.
3. Drag the cube out and rotate it around each axis.
4. You can change the color of the cube and flip it horizontally or vertically.

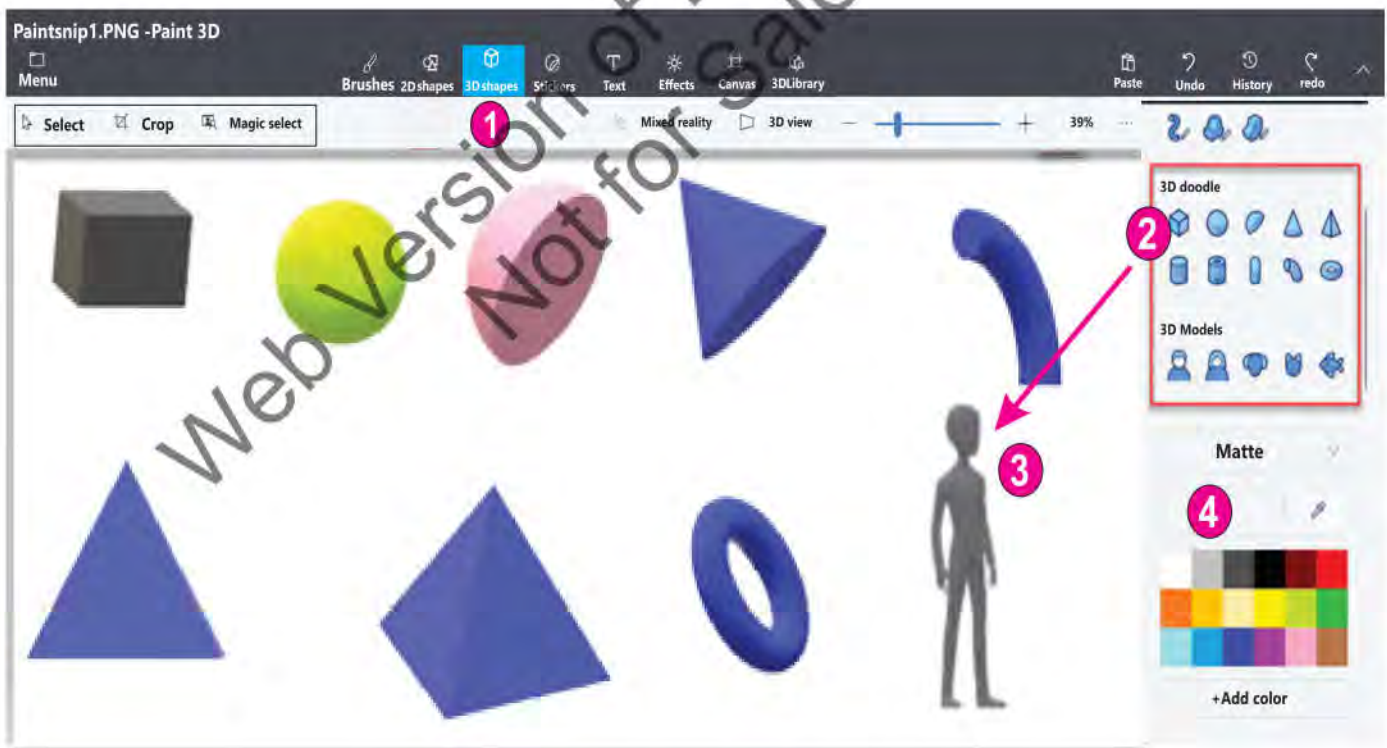


Fig 3.26 3D object

Tips:

You can add more colors of your choice to the color palette by editing colors

3.10.3 Create 3D doodles

Doodle is defined as an aimless or random drawing or scribbling. It is possible to practice doodling on 3D paint application. The following are the steps to create 3D doodles:

1. Select the 3D shapes tool.
2. Select the 3D doodle option.
3. Select the colour.
4. Drag out from the options while clicking on the mouse to create a free hand shape and curve.

You can modify the shape by rotating it around its x axis.

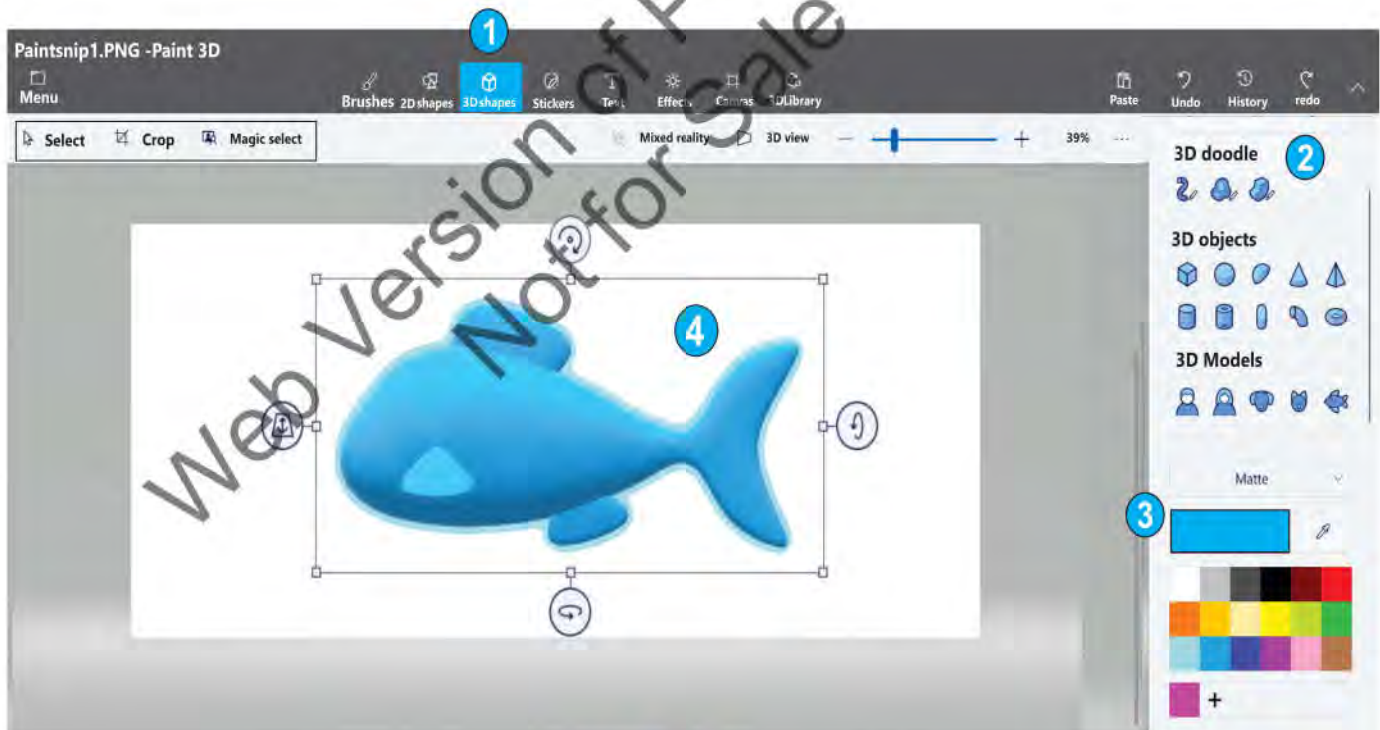


Fig 3.27 3D doodle

3.10.4 Create 3D text

The text tool in 3D Paint provides with several option of writing in 2D, 3D and changing colors, sizes, font, style and alignment.

This can be done by following the below mentioned easy steps:

1. Select the text tool, and then select the style options.
2. Select the font and the style options.
3. Click outside the text box.
4. Edit, rotate and flip the text as required.

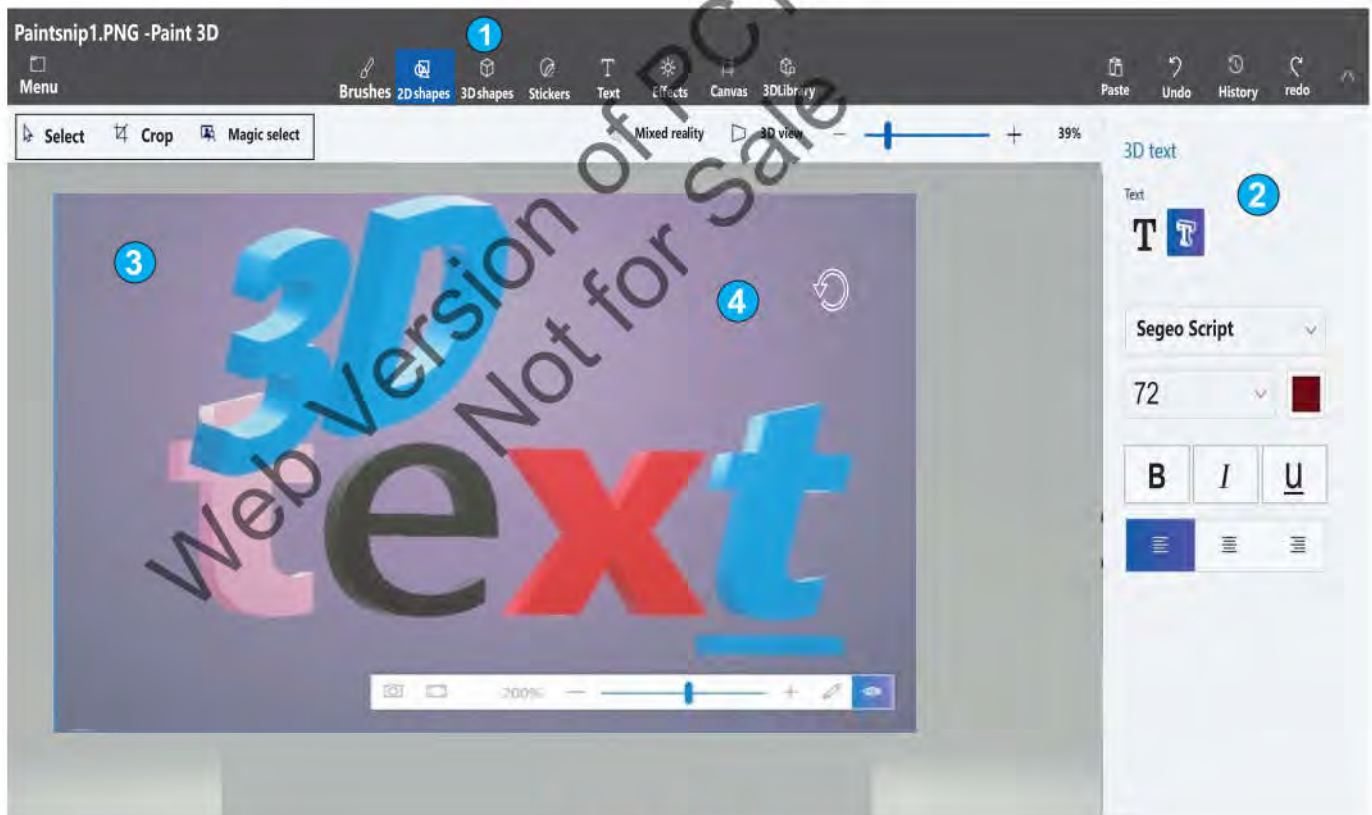


Fig 3.28 3D Text

3.10.6 Use image stickers

Following are the steps to create image stickers:

1. Select 3D shapes tool from Toolbar.
2. Select the 3D mode and Drag out an object.
3. Select stickers tool
4. Add the eye and mouth stickers to complete the animated look.
5. Confirm the stickers by rotating an object.

Tips:

- Edit the color of an object by option Add color.
 - Select brushes tool to paint different parts of an object.
- The history tool has history slider that show the step while creating a Paint 3D

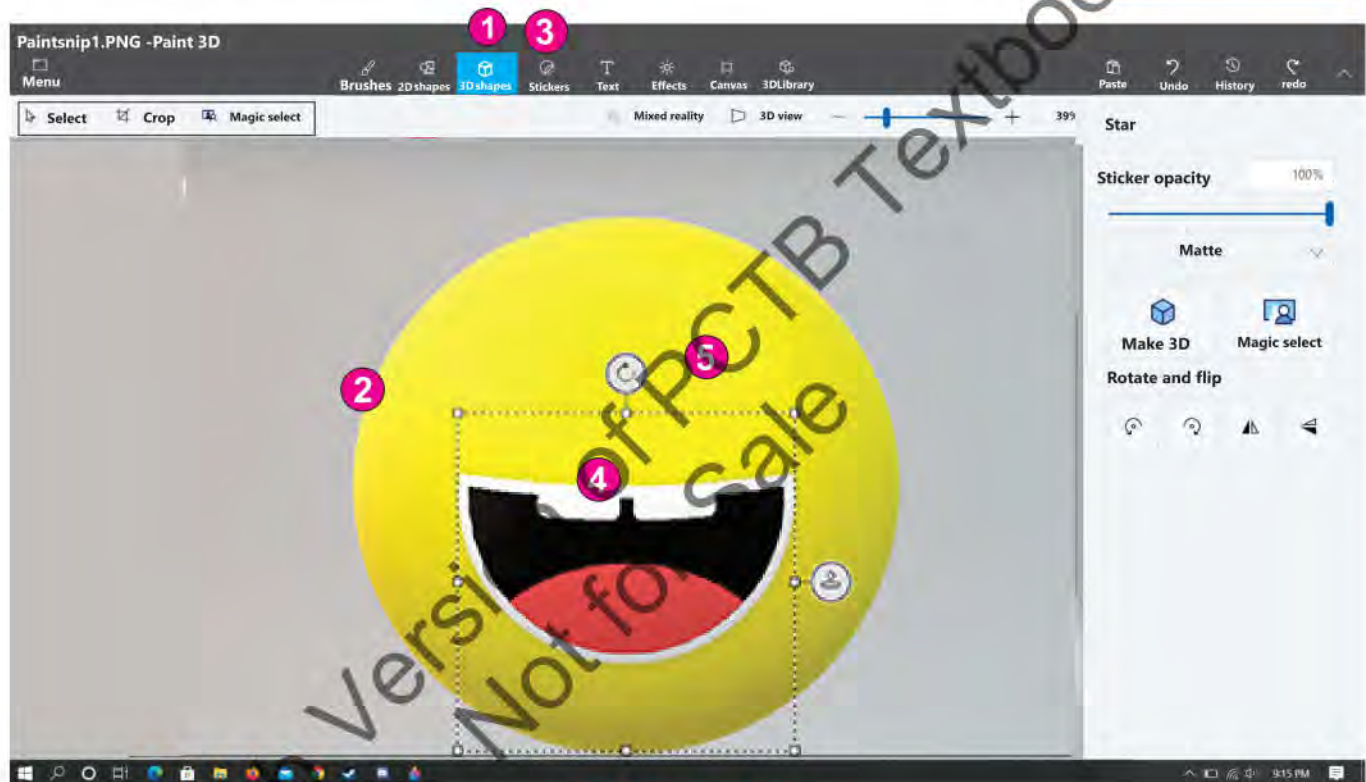


Fig. 3.29 image Striker

3.10.7 The canvas

The canvas is like a 2D sheet of paper and the 3-dimensional objects can be moved in front or behind the plane of canvas. You can do this by selecting the Canvas tool and then selecting different options.

3.11 Navigating the Internet

3.7.1 Web Browser:

The web browser is an application software that opens webpages to allow us to view information from the internet. There are several examples of web browsers, such as Internet Explorer, Google Chrome, Opera, Safari and Mozilla Firefox.

A browser can access information on World Wide Web (WWW) and display it on your computer or mobile device. World Wide Web can be defined as a Global collection of websites that the computer user can access via internet. Moving from one page to another and viewing information on them is known as surfing on the internet.

The illustration below shows the main parts of the Google Chrome window:

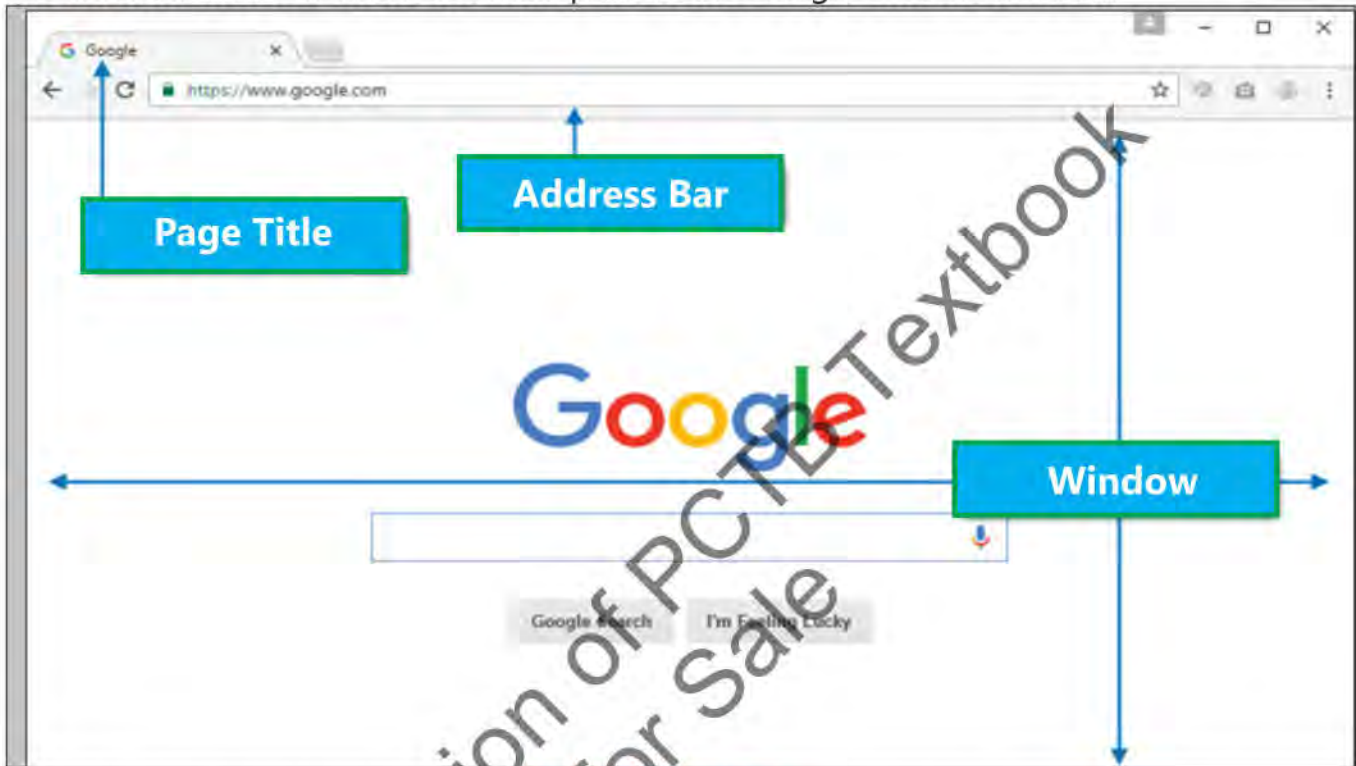


Fig. 3.30 Google page

- We can type the address of the webpage we want to visit in the address bar.
- The menu buttons have all the useful commands. It is from this menu that we can open a new window, print, and manage bookmarks.
- The webpage section displays the content of that webpage.
- When we click on the new tab button, a new tab will open.

The following is the labeled illustration of some important buttons:

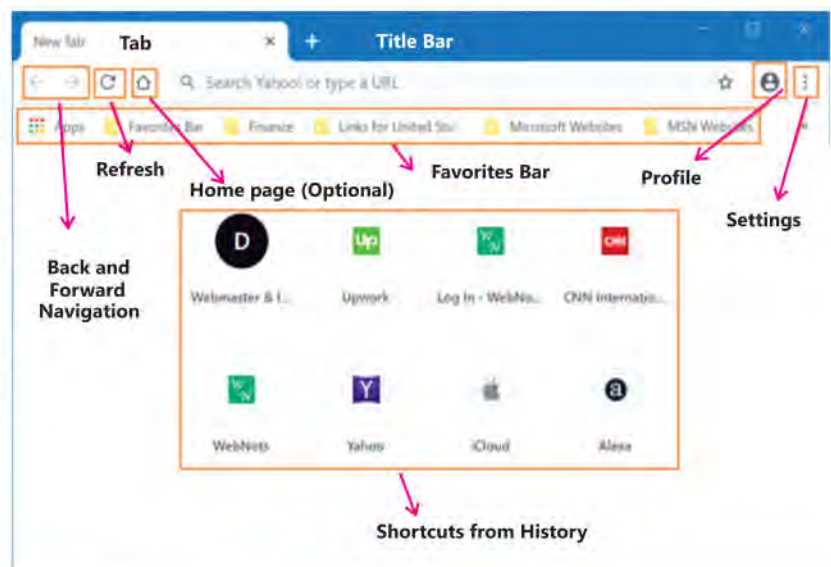


Fig. 3.31 Buttons in Webpage

3.7.2 Search Engine

A search engine is a website that allows us to search for information on the internet. Popular examples of the search engines includes Google, Yahoo, Kidzsearch, Ask and Microsoft Bing.



Fig. 3.32 Search Engine

We can do the following on the search engine:

- Research a topic and gather information about it.
- Find and save pictures and images.
- Search for and download files and programs.

Tips:

Typing can be improved by limiting your hand and finger movement. Don't rush instead practice all typing lessons to ace this skill.



Fig. 3.33 safari

3.8 Using Rapid typing Tutor

This is one of the most used software applications that is used to learn and enhance the typing skills of the user. It aids in developing the keyboarding skills. Keyboarding means typing on the keyboard using the correct fingers. Each finger on your hands should be placed correctly on the specific key on the keyboard. It is very important for the user to know the correct sitting posture when using the keyboard.

3.8.1 Prescribed sitting posture when keyboarding:

- Sit upright and keep your back straight
- Keep your elbow bent at an angle of 90.
- Face towards the monitor with head slightly inclined forward.
- Keep an ideal distance of at least 45-70 cm from the screen.
- Sit in a way that your shoulders, arms and wrist muscles are in least stress. The wrist should touch the table top in front of the keyboard making sure that the body weight is not shifted to the wrists.



3.8.2 Home Row position

It is very important to know the skill of keyboarding when using the computer. As specified earlier that the fingers are required to be on a specific key on the keyboard, we must use both our hands with thumbs resting on the space bar. Fingers from the left hand should be

Tips:

The figure to the right shows the labeling of the fingers on your hand.



placed on ASDF and fingers from the right hand should be placed on JKL; The illustration below shows the correct placement of the fingers on the keyboard when keyboarding:

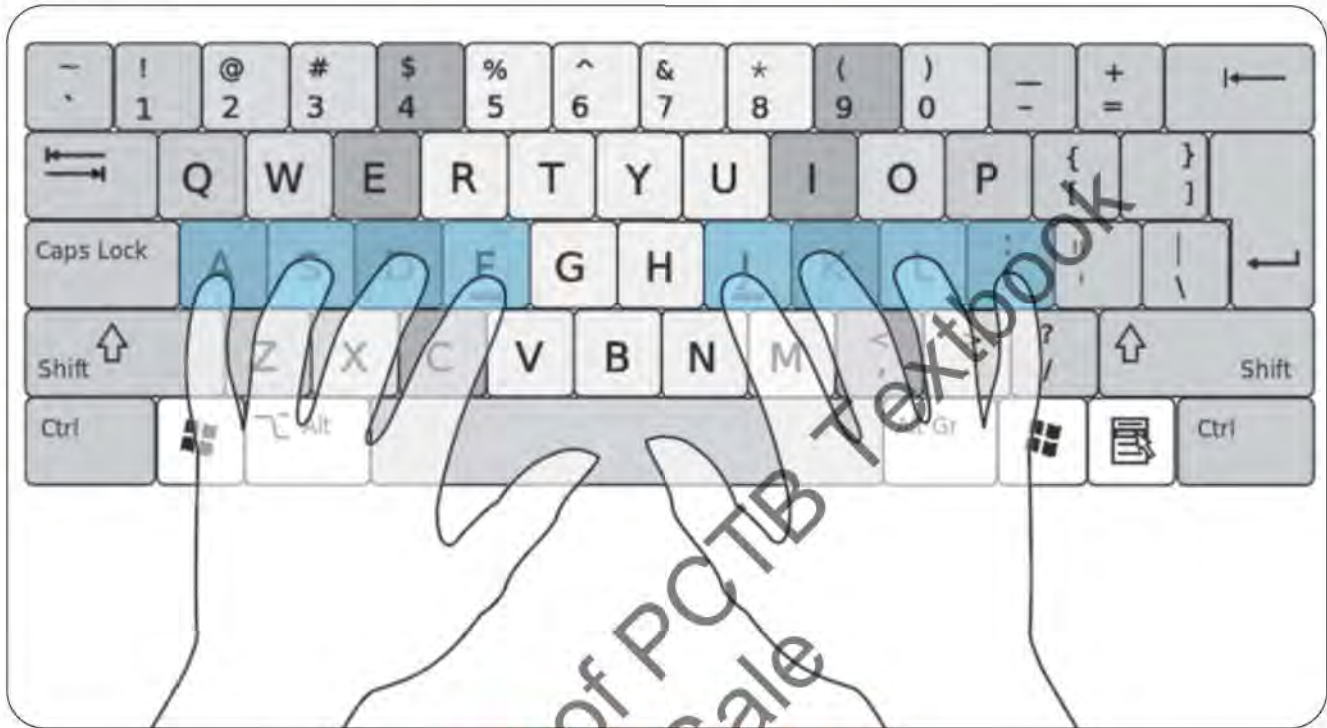


Fig. 3.34 Finger placement on keyboard

The color-coded keyboard will help us understand keyboarding better.

- Use the fingers on the specified keys on the keyboard only.
- When typing always return to the primary placement of ASDF and JKL.
- Maintain a practice of typing at equal intervals.
- The shift key is always pressed with the Pinky finger on both the hands.
- The thumbs from both the hands should always be resting on the space bar.
- Speed is secondary whereas accuracy is more important.

Summary

- Software is defined as a set of instructions, data and programs that are used to operate computer and perform a specific task.
- System Software is a type of program that is designed to control and manage the computer's internal and external resources.
- The operating system is a system software that controls and manages all operations of the computer.
- There are four basic types of system software:
 - Operating system
 - Device Driver
 - Utility Program
 - Language Translator
- A file can be defined as a common storage unit on the computer.
- A folder (directory) is a collection of files in order to organize them on a storage device.
- Shortcut is a link to the file created to easily access it. Shortcuts can be created on the desktop and in other folders.
- Entertainment Software is solely designed for the sake of entertainment.
- Productivity Software are used to produce information in form of a text document.
- Paint 3D is a raster graphics and a 3D creative application that is a refresh of Microsoft Paint.
- The web browser is an application software that opens webpages to allow us to view information from the internet. There are several examples of web browser, such as Internet Explorer, Google Chrome, Opera, Safari and Mozilla Firefox.
- A search engine is a website that allows us to search for information on the internet.
- Typing Tutor is one of the most used software applications that is used to learn and enhance the typing skills of the user.
- Keyboarding means typing on the keyboard using the correct fingers.



Exercise

Tick (✓) the Correct option:

1. The window in use on the desktop is known as a _____.
a. Actual b. Dynamic c. Active d. Live
2. The process of moving from one web page to another is known as:
a. Changing b. Switching c. Transferring d. Browsing

3. Antivirus is an example of:

- a. Application software
- b. Utility program
- c. Device driver
- d. Operating system

4. A software used by the teachers and students for enhancing their learning skills and activities is an example of:

- a. System software
- b. Educational software
- c. Gaming software
- d. Operating system.

5. A software that is developed to do a specific task on the computer is called:

- a. Operating system
- b. Entertainment software
- c. Gaming software
- d. Application software

6. Which of the following tool is Paint 3D and is used to copy:

- a. Crop tool
- b. Snipping tool
- c. Clone stamp tool
- d. Curve tool

7. We can change the size of the marker using the _____ tool.

- a. Marker
- b. Eraser
- c. Canvas
- d. Crayon

8. _____ is the link to the original file.

- a. Icon
- b. Shortcut
- c. Taskbar
- d. Folder

9. _____ is the collection of files.

- a. Folder
- b. Desktop
- c. Icons
- d. Applications

10. _____ is a website that allows us to search for information from internet.

- a. Web browser
- b. Websites
- c. Applications
- d. Search engine

Briefly answer the following questions:

1. What is Search engine? discuss any two.
2. Differentiate between 2D and 3D Shapes?
3. Define software.
4. Differentiate between utility software and device drivers.
5. Enlist Language Translators.
6. Write a note on Snipping tools in windows.
7. Write down the usage of Notification area in windows.
8. Differentiate between file and folder.
9. What is productivity software?
10. Discuss Educational software.

Answer the following questions in detail:

1. Discuss system software.
2. Discuss any two examples of operating systems.
3. Write down the functions of OS.
4. What is application software? list down its types.
5. Write a note on web browsers.

Project Based Questions:

1. Identify the operating systems installed in the computers in your computing labs at school.
2. Practice typing a research report on "my favorite National Hero" in Microsoft Word. This should be approximately 300 words of research. Save your work on the computer and get a print out to display on the pin boards around the school after marked by the teacher.
3. Following are the steps for searching information on Google search engine:
 - Open the web browser.
 - Enter the website address, like www.google.com
 - Enter the specific words for the information you want to find, for example "dessert Safari" and press enter.
 - View the search results.
 - Click on the web link in the results which most relevant.
 - View and navigate through the information that you are looking for.
4. Create a Solar system in 3D Paint. Draw all planets by using the feature of 3D shapes. Distinguish the planets with different colors and show creativity by labeling them by the text tool. Draw planet orbits around the planet were required.
5. Create a table in Microsoft word, listing examples of different types of software. The examples can be written under the heading of the software, for example entertainment software, educational software and productivity software. Research online and list the examples of each in the table that you inserted.
6. Plug and Play (PnP) is the technology that allows the Operating System to automatically detect the peripherals devices, without using any Device Driver. Identify some Plug n Play devices.

Activity Based Questions

1. Divide the students into pairs. Ask them to create a folder on the desktop and rename it. Instruct them to delete the folder and empty the recycle bin. Observe the students and guide them where help is needed.
2. Divide the students into pairs. Explain to students that each pair is going to use an image processing software to draw a given prompt (for example, draw a house). Instruct students to open the software. Demonstrate how to use each of the "paint tools" and how to edit/erase. Demonstrate to the students how to use the spray paint, creating different shapes and colors. Students may use 3 different colors, 3 different shapes, and text. Ask if there are questions. Students will practice using the basic tools for 5 minutes. Give students 30 minutes or whatever time they need to draw and paint their house. Take a round to observe and guide the students as required. This activity is to mainly enhance a student's fine motor skills while allowing him/her to express inner creativity.

Algorithmic Thinking

Students Learning Outcomes

After completing this unit students will be able to:

- Define and identify a problem.
- Analyze different techniques to deconstruct a problem
- Differentiate between simple and complex problems.
- List benefits of algorithmic thinking.
- Recognize that algorithms are a sequence of precisely described instructions.
- Examine that Algorithmic thinking is breaking down a problem, identifying important information, logical thinking, and confidence in decision making.
- Define conditional statements/ selection statements that decide whether certain instructions should run (e.g. if there is rain take an umbrella)?
- Identify loops, and analyze how they allow instructions to be repeated.
- Analyze ways to solve a problem by using a combination of sequence, selection, and repetition.

Identify:

- What is given – facts
- Data needed to solve the problem – input.
- The output of the problem when given a certain input.
- Specific instructions vs. nonspecific instructions.
- Deconstruct a problem into sub-problems
- Integrate solutions to sub-problems to solve the main problem.
- Using given data and facts, reason about conclusion (guess the identity of a classmate given a set of qualities/features).
- Identify and differentiate between simple and complex problems.
- Create a sequence of steps to solve a problem.
- Relate sequence, selection, and repetition to daily life tasks.
- Create solutions to problems using sequencing, loops, and conditions.

4.1 Problem solving

A problem may be a task to be performed. It can be thought in terms of inputs and matching outputs. The problem can come from real-world or it can be pointed out by someone. To solve a problem we need to have a systematic problem solving process. We can say that problem solving is the sequential process to analyze information related to a given situation and generating appropriate solutions.

There are 6 steps that you should follow in order to solve a problem efficiently:

- Identify problem
- Problem definition
- Problem analysis
- Planning solution
- Test the solution
- Selecting best solution

Consider a simple example of how the input/process/output works on a simple problem:

Calculate the average age of all students in a class.

1. Fact: students of a class
2. Input: get ages of all students
3. Specific instruction (Process): add them all and compute the average age.
4. Output: output the answer

As you can see, the problem is easily solved by simply getting the input, computing something and producing the output. Let us now examine the steps to problems solving.

4.1.1 Identify a Problem

We have to be clear and specific in identifying the problem. Once identified, the problem should be stated in a simple and clear fashion hence it can be solved easily.

4.1.2 Defining a Problem

A problem is said to be well defined if it does not contain any ambiguity. It is clearly defined and it has a clear goal. If a problem is clearly defined it can be solved easily. If a problem is not defined clearly we can use different strategies such as "Guesses", Picture drawing etc., to properly define a problem.

4.1.3 Problem Analysis

Problem analysis is the process of defining a problem and decomposing a problem into smaller parts to identify possible inputs, processes and expected outputs related to the problem. It is process of figuring out 5 W's i.e., What, When, Where, Who and Why from problem statement.

Deconstruction of a problem

Deconstruction is the process of taking a big problem and breaking it down into a set of smaller problems. If you can solve all of the smaller problems you will have solved the big problem.

Examples:

Consider we have a recipe of Pasta and our goal is to determine its ingredients. We can analyze the given problem using following steps:

Fact (What is given): Empty recipe have ingredients

Input (Data needed): Pasta recipe

Output: Ingredient of Pasta

Instructions: We have to separate ingredients of pasta recipe

Let us analyze another problem:

We have to design a maze problem with a robot that can follow the set of instructions to perform any action.

You may feel that you don't know the first thing about solving a maze problem. But you actually know how to do some of it. Let's break this one problem down into smaller parts — it may look something like this:

Fact (What is given): Maze

Input (Data needed): Source/ starting point and target/ ending point of given maze

Instructions:

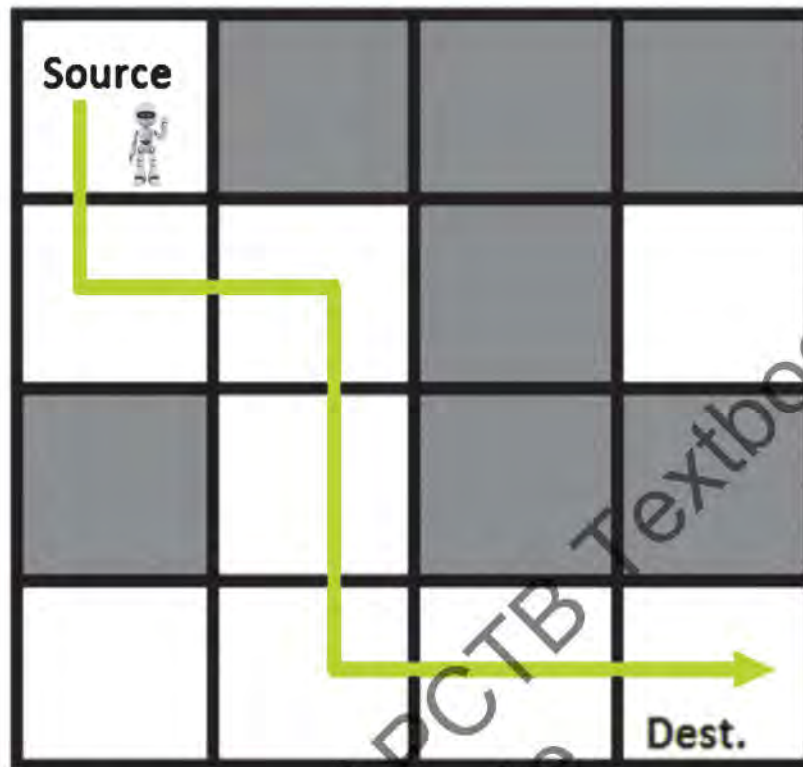
- Determine the size of the matrix that you want i.e., $N \times N$ (N = number of rows and columns)
- Decide that the robot will start from source i.e., maze $[0][0]$ and its destination is maze $[N-1][N-1]$.
- Robot can move only in two directions forward and down.
- Gray blocks are dead ends (value = 0)
- Following is a maze with highlighted solution path.



Fig. 4.1 Maze

Extra Bit!

We always represent matrix / table by [col]



Output: Root from source to target
 So, you've already broken the "Maze" problem into smaller problems. You can now take each of these smaller problems and break them down into even smaller problems. This process is called the art of **deconstruction**.

Extra Bit!

Sometime we have clear instructions to solve a problem these instructions are called specific instructions. Sometime we have not clear instructions or requirements of the algorithms and we have to extract them from problem statements. These are called non-specified instructions.

Techniques to deconstruct a problem

Following techniques can be used in deconstruction of a problem:

1. Separate root cause of the problem to navigate the problem space.
2. Draw limits of problem.
3. Identify statements which appear easier to solve.
4. Identify 5 W's from problem statement (What, When, Who, Where, Why)
5. Start solving parts of problem (Easier to difficult)
6. Combine all sub-solutions to make a main solution.

4.1.4 Planning solution

Good planning is essential for the successful execution of a solution. It ensures that you have everything you need and solve a problem. This will minimize risk of failure.

There can be more than one solution for a problem. Alternate solutions can enhance the value of your ideal solution. Once you have decided on the "what should be the result", this target will become the basis of your solution.

4.1.5 Testing and selecting best solution

We can use lists of advantages and disadvantages to evaluate and choose the best available solution to meet our needs.

Following factors can be considered while selecting solution:

- Difficulty level
- Time to implement the solution
- Cost on implementation the solution

4.2 Simple problems

A problem is known as simple problem if it requires less time and resources to be solved. A problem that can be solved in simple steps is considered "easy" in most contexts, even if it is large.

Example: Turning on a fan, writing the table of a specific number.

4.3 Complex problems

A problem is known as complex problem if it requires more computational time and resources to be solved. The complex problems that cannot be solved in simple steps are called complex Problem.

Example: Drawing a car, finding the area of a irregular shape.

4.4 Computational Thinking

Computational / Algorithmic thinking is a way of getting to a solution through the clear definition of the steps needed to solve a problem. This approach automates the problem-solving process by creating a series of systematic, logical steps that take a defined set of inputs and produce a set of outputs based on instructions given by the users.

Algorithmic thinking is not solving a specific problem; instead, it shows how to build a process that has an end point and it solves all the problems efficiently.

4.4.1 Benefits of Algorithmic Thinking

Algorithmic thinking provides a unique way to solve problems, and design new and improved systems. Following are some benefits of Algorithmic thinking:

Decomposition: We learn how to break down complicated problems into smaller problems.

Abstraction and Generalization: We can focus on the important information only, ignoring irrelevant detail.

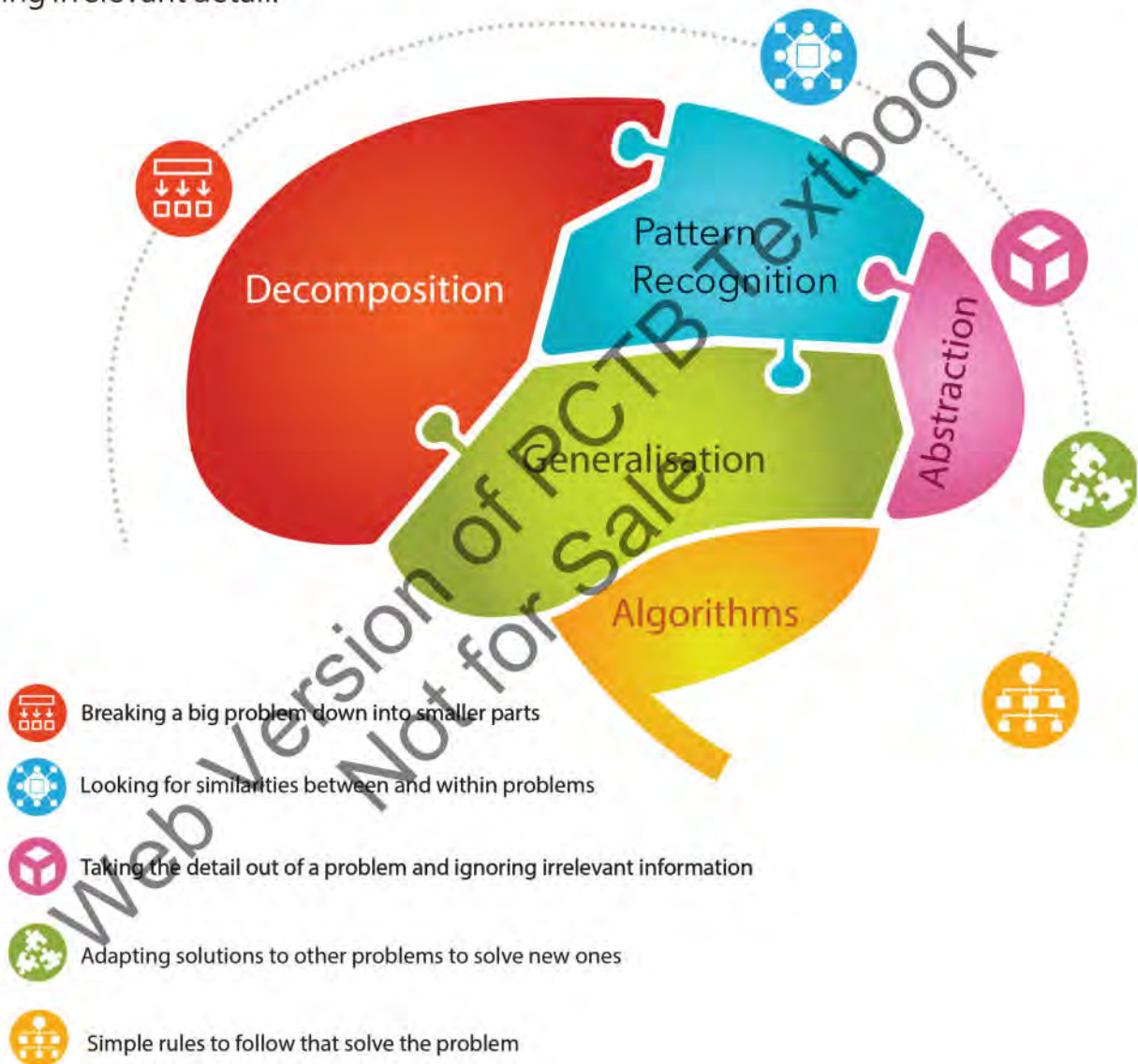


Fig. 4.2 Computational Thinking

Pattern Recognition: We look for similarities among and within problems

Generalization: We identify sequence of operations that are common among specific problems and to extend them to the general problems.

Algorithmic design: This design allows the people to follow the instructions to solve a

problem.

Confidence in decision making: Algorithmic thinking improves the confidence in decision making.

4.5 Algorithm

An algorithm is a finite sequence of instructions used to solve a specific problem or to perform a specific task. In other words it is a procedure used for solving a problem or performing a computation. Algorithms are used in all areas of computer science for problem solving.

4.5.1 Examples of Algorithms

Sequential flow

In sequential flow process must execute in the same written order.

Algorithm to make a tea

- Step 1: Start
- Step 2: Fill the kettle with water
- Step 3: Put the tea leaves in the kettle.
- Step 4: Boil the water in the kettle.
- Step 5: Pour some of this boiled water in the cup.
- Step 6: Add milk to the cup.
- Step 7: Add tea whitner to the cup.
- Step 8: Stir and drink the tea.
- Step 9: Stop

Algorithm to polish your shoe

- Step 1: Start
- Step 2: Open the shoe polish
- Step 3: Put shoe polish on brush
- Step 4: Polish one shoe
- Step 5: Put shoe polish on brush
- Step 6: Polish the other shoe
- Step 7: Close the shoe polish
- Step 8: Stop

Algorithm to add two numbers

- Step 1: Start
- Step 2: input two numbers A and B
- Step 3: $\text{Sum} = A + B$ (add the values of A and B save in "sum".)
- Step 4: Print the value of Sum
- Step 5: Stop

Conditional flow

In a conditional flow, steps are executed only if the condition is true otherwise next step is executed.

Algorithm to print greater number from two numbers

Step 1: Start
Step 2: Input two Numbers A and B
Step 3: check if A is greater than B then go to step 4 otherwise go to step 5
Step 4: Print A is greater than B
Step 5: Print B is greater than A
Step 6: Stop

Note:

At step 3 we are deciding weather to execute step 4 or step 5. In computational thinking this is called decision making. IF-else statement is used for decision making.

Algorithm to that take a number from user, it will print Car if number is 1 otherwise print Bus

Step 1: Start
Step 2: Input a Number A
Step 3: check if A is 1 then go to step 4 otherwise go to step 5
Step 4: Print Car
Step 5: Print Bus
Step 6: Stop

Algorithm to print whether a number is Even or Odd

Step 1: Start
Step 2: Input a Number A
Step 3: $\text{mod} = A \text{ modulus } 2$
Step 3: If mod is zero go to step 4 else go to step 5
Step 4: Print A is even and go to step 6
Step 5: Print A is odd
Step 6: Stop

Repetitive flow

Repetitive flow, also referred to as iterative flow, is a process in which a set of statements is executed again and again until a certain condition remains true.

Algorithm to print table of given Number up to 10

Step 1: Start
Step 2: Input a Number A

Step 3: counter = 0
Step 4: If counter is less than 10 go to step 5 otherwise go to step 8
Step 5: counter = counter + 1
Step 6: Print variable A, counter and their product $A * \text{counter}$.
Step 7: Go to step 4
Step 8: Stop

Note:

In above algorithm we are repeating step 4 to step 7 again and again until condition at step 4 remain true. These steps are called loop.

Algorithm to print first ten integers

Step 1: Start
Step 2: counter = 1
Step 3: if counter is less than 11 go to step 4 otherwise go to step 7
Step 4: Print counter
Step 5: Increment the value of "counter" by 1
Step 6: Go to step 3
Step 7: Stop

Summary

- Any task to be performed which can be thought in terms of inputs and matching outputs is called problem.
- Problem solving is the sequential process to analyze information related to a given situation and generating appropriate solutions.
- We can reduce the risk of failure by proper planning of a solution.
- A problem is known as simple problem if it does not requires more computational time and resources to be solved.
- A problem is known as complex problem if it requires more computational time and resources to be solved.
- Identifying similarities among and within problems is called pattern recognition
- Algorithmic design allows the people to follow the instructions to solve a problem.
- An algorithm is a finite sequence of instructions used to solve a specific problem or to perform a specific task.
- In sequential flow process must be executed in the same order in which they are written.
- In a conditional flow, step or set of step with set of steps are executed only if the condition is true otherwise next step is executed.
- In repetitive flow, a process with a set of statements is executed again and again until a certain condition remains true.



Exercise

Tick (✓) the Correct option:

1. First step of systematic process of problem solving is:
 - a. problem analysis
 - b. planning solution
 - c. problem identification
 - d. test solution
2. _____ is process of defining and decomposing of a problem.
 - a. problem analysis
 - b. planning solution
 - c. problem identification
 - d. test solution
3. Breaking down a big problem into smaller problems is called:
 - a. problem identification
 - b. problem decomposition
 - c. planning solution
 - d. selecting best solution
4. Looking for similarities among the problems is called:
 - a. Algorithmic design
 - b. pattern identification
 - c. problem decomposition
 - d. abstraction
5. Thinking the domain of problem and ignoring irrelevant material is called:
 - a. algorithmic design
 - b. problem decomposition
 - c. pattern identification
 - d. abstraction
6. _____ is finite sequence of instruction to solve a specific problem.
 - a. Algorithm
 - b. unspecified instructions
 - c. specific instructions
 - d. None
7. Every algorithm has _____ and _____:
 - a. loop, condition
 - b. start, stop
 - c. finite, infinite loops
 - d. sequence, conditions
8. In _____ flow, steps will be executed in the same sequence they are written in.
 - a. Repetitive
 - b. sequential
 - c. conditional
 - d. none
9. In _____ flow, steps are executed only if certain condition is true.
 - a. Repetitive
 - b. sequential
 - c. conditional
 - d. none
10. In _____ flow, set of statements is executed again and again until a certain condition remains true.
 - a. Repetitive
 - b. sequential
 - c. conditional
 - d. none

Answer the following questions briefly

1. List down the benefits of step by step process of problem solving.
2. How identification of problem is helpful in problem solving?
3. What do you mean by problem analysis?
4. Differentiate between specific and nonspecific instructions in problem solving.
5. How does planning solution reduce the risk of failure?
6. List the elements that we must consider while selecting a solution.
7. Differentiate between simple and complex problems.
8. What do you mean by pattern recognition in problem solving?
9. List down benefits of computational thinking.
10. Differentiate between conditional and repetitive flow.

Answer the questions in detail

1. How can you say that a problem solving is helpful in everyday life?
2. Discuss the steps of problem solving process.
3. What is deconstruction of a problem? List down its benefits.
4. What are the techniques used in deconstruction of a problem?
5. How does computational thinking help us in solving a problem?

Project Based Questions

1. Write an algorithm that create a pizza with 4 toppings.
2. Write an algorithm that gives the steps involved with brushing your teeth.
3. Write an algorithm to find sum and average of three numbers.
4. Write an algorithm to find product of two numbers.
5. Write an algorithm to find whether a number is even or odd.
6. Write two different algorithms to find product of two numbers and choose the best one among them.
7. Write an algorithm that allows a person to enter a number, algorithm will print table of that number up to 10.

Activity Based Question

1. Ask the students to come up with a rule – something that always happens in the same way. For example, "I go to school on Mondays". Then, come up with an exception, also known as a condition, to this rule. For example, "If it is a holiday, then I don't go to school on Monday." Write the conditional statement at the top of a piece of paper. Use the rest of the paper space to illustrate the conditional statement. In this example, you could draw a picture of your favorite holiday. Repeat this process 3 times so you have three conditional art pieces! If working in pairs, one partner can come up with the rules, and the other can come up with the condition and draw the image. Then, switch roles.

Programming

Students Learning Outcomes

- Define program.
- Determine the need for a programming language.
 - Differentiate between an algorithm and a program.
 - Convert an algorithm into a program.
- List ways in which programming is important in today's world.
- List different applications of computer programming.
- Identify programming language and their uses.
- Recognize that a program executes in a sequence – Write computer programs accordingly.
- List the fundamental programming constructs that enable a computer to interpret a computer program. The constructions are:
 - An event is an action from the user or something outside the computer.
 - A sequence is a series of actions that are completed in a specific order. Computer follows all instructions in the sequence in which they are written.
 - A loop repeats instruction until specific stopping condition is met.
 - A variable is used to store information called a value.
 - A conditional statement asks a question to figure out which path to take next.
- Analyze ways to debug a computer program.

5.1 What is a program?

A program is a set of instructions given to the computer to perform a specific task. It is a ordered sequence of instructions that are necessary to achieve a solution. A program has variables and constraints (which represents data, text and images.) and a list of instructions that are called statements.

Programs stored in the memory of computer enables the computer to perform variety of

Do you Know?

First digital computer that could run a program was the "Baby," constructed at Manchester in 1948.

tasks. The idea of an internally stored program was introduced in the late 1940's by the mathematician John von Neumann.

The development of a program starts with a task, and then expressing it in a computer language. Programs are created using specific programming languages such as python, it is easy to write programs increase languages and these programs are translated into understandable machine languages by compilers and translators.

Program Vs Software.

Program is a set of instructions that enables computer to perform a specific task. It usually doesn't have a separate user interface. When many programs are bundled together to perform a big task, it becomes a Software. Software has their own user interface from where you can use it programs. For example, Microsoft Paint is a Software that contains many programs like changing the color, selecting a brush, drawing a rectangle etc.

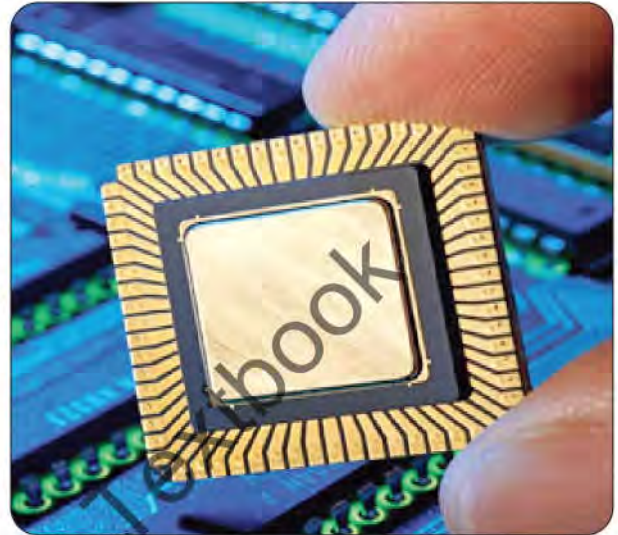


Fig. 5.1 Processor chip

5.2 Programming

Programming is process of writing. The process of creating and writing a program is called programming. It is a creative task. There are choices to be made in this process, where one option may suit better than the other. This doesn't mean that the other is wrong to solve different problems.

Computers are machines which work when we give them instructions. These instructions are provided to the computer in the form of programs.

Developing a program involves the following systematic procedure with the below mentioned steps:

1. Analyze the problem
2. Design the program
3. Write a program
4. Document and maintain the program.



Fig. 5.2 Programming

The first step is to study and identify the problem to get the useful information. The problem should be analyzed well. The actual problem is divided into sub-problems. In order to find the solution, the user can use algorithm and flowcharts.

Design the solution

In designing phase, we establish a clear idea of which problem we are going to solve for the user. We shape the problem statement which helps us throughout the designing phase. Algorithms and flowcharts are designed for better understanding.

Write a program

In this phase, algorithms or flowcharts are converted into programs easily understandable by the computer. This step is also known as coding.

Document and maintain the program

Documentation is a written detailed description of the programming process. It contains all facts about the programs. Usually, it includes problem statement, brief description of problem, data and facts about the problem, tools used to understand the problem, algorithms, flowcharts, code examples and many more. Comments in the program itself are also considered an essential part of documentation. Many programmers document as they code.

5.3 Importance of Programming in today's world

Computer programming is the most fundamental skill to learn for almost every application. It forms the most essential part of software development or cutting-edge research into artificial intelligence. It has transformed the world into a better place. Programming is not only making the tasks easier for us to perform but it also significantly improving the businesses and operations across the globe. In the world of modernization and constant development in technology the students find these programming skills essential to trouble shoot these automation tools. In this way the coming generation is in a much better position to contribute towards the maximization of technology investments.

Technological progress continues to evolve at a rapid pace. Every smart phone app, website, computer application, and even a microwave and calculator use a code to function. Naturally, digital talent is in high demand. However, many young people continue to be digital consumers rather than creators.

As coding becomes more



Fig. 5.3 Importance of Programming

common in our daily lives, digital skills are becoming increasingly important for aspiring minds looking to advance in their careers. Young people must take advantage of opportunities to broaden their digital expertise.

5.4 Programming Language

Programs are written in programming languages. These programming languages provide us the facility to write programs in text base editors or in visual mode. The languages that are easily understandable by computer are known as low level languages whereas the languages that are near to human languages are called high level languages. High level languages need to be translated into low level language so that the computer can understand them. Programming language can be categorized as under:

1. Machine language/low level language
2. Assembly languages/intermediary language
3. High-level languages

Do you Know?

The first widespread use of high-level languages in the early 1960s revolutionized the process of programming.

Let's look at each of these categories.

Machine Language

Humans do not like to deal in numbers alone—they prefer letters and words. But, strictly speaking, numbers are what machine language is. This low level language, machine language, represents data and program instructions as 1s and binary digits corresponding to the on and off electrical states in the computer. Each type of computer has its own machine language. In the early days of computing, programmers had basic systems for combining numbers to represent instructions such as add and compare.

Assembly Language

Assembly language is considered intermediate that is, they are not as easy for people to use as more recent languages. At the time they were developed, however, they were considered a great leap forward. Furthermore, assembly languages permit the use of names for memory locations instead of actual address numbers. Just like machine language, each type of computer has its own assembly language.

The programmer who uses an assembly language requires a translator to convert the assembly language program into machine language. A translator is needed because machine language is the only language the computer that can actually execute. The translator is an assembler program, also referred to as an assembler. It takes the programs written in assembly language and turns them into machine language.

High-Level Languages

Programs are written in an English-like manner, which make them more easy to use. As a result, a programmer can develop more programs with less effort, and programs could

now solve much more complex tasks. A translator such as computer is needed to translate high level language into machine language.

Program Constructs

All programming language use program constructs. In other words, they are used to control the flow in which the statements are executed. Basic programming constructs are listed below:

1. Sequences

In sequences, the instructions of a programs are executed in the same sequence as they are written, one after the other. This is the natural flow of working most of the time. For example, to make a tea, you follow the sequence of instructions.

2. Selection

A selection statement provides for selection between alternatives. In many languages, if statement is used for selection:

```
If statement is a conditional statement. For example, if (number is divisible by 2)
    print that number is even
else
    print that number is odd.
```

Activity of loop:

Teacher will place different balls in one corner of the class and an empty basket on the other corner. A student will be asked to pick one ball at a time and put in the basket. The student will repeat this activity to put all balls in the basket.

3. Repetition

A repetition construct causes a group of one or more program statement to be repeated until some end condition is met. Typically, such constructs are use to step through a raised or linked list. We can identify two main forms of repetition:

- Finite
- Infinite

Some Terms Used in Programming

Constant

A constant is a value that remains consistent during the execution of a program, A constant can be a number, character or a sequence of a character string.

Variables

A variable is defined as a container in which we may have different values during the execution of a program. Variables are named memory locations that are used to store

program's data. Each variable is given a distinct name. When the program runs, different memory locations are allocated to variables. The data is stored in the memory and read from it's with the reference to variable name.

Syntax

Syntax refers to the spellings and grammar of language used for programing. Syntax defines the use of words, numbers, and punctuation of a programing language.

Syntax Error and Logical Error

Each programing language has its own rule. If the rules of programing language are not followed properly, the resulting error is called the syntax error. A program with syntax error is not valid, hence it crashes when it runs. Incorrect punctuation, incorrect word sequence, or misuse of term results in syntax error. If the rules of the program are followed correctly but the programmer made any other mistake, it is then the logical error. In that case the program will run, but the results of the program would not be as intended.

Visual Programming Language Scratch:

Scratch is a visual programming language that doesn't require writing of commands. It is very easy and assessable to use as you can create a program just by arranging the blocks in the proper order.

There are two ways in which you can use scratch:

- By downloading the file to your personal device.

By working online on its website, i.e. <https://scratch.mit.edu>

5.5 Scratch

Scratch is a programming software that makes it easy for us to create interactive games, animations and stories. When scratch opens, it displays a single character by default that is called sprite. We can program sprite to move and interact with the user.

When we open sprite, the following is the displayed interface:



Fig. 5.4 Sprite

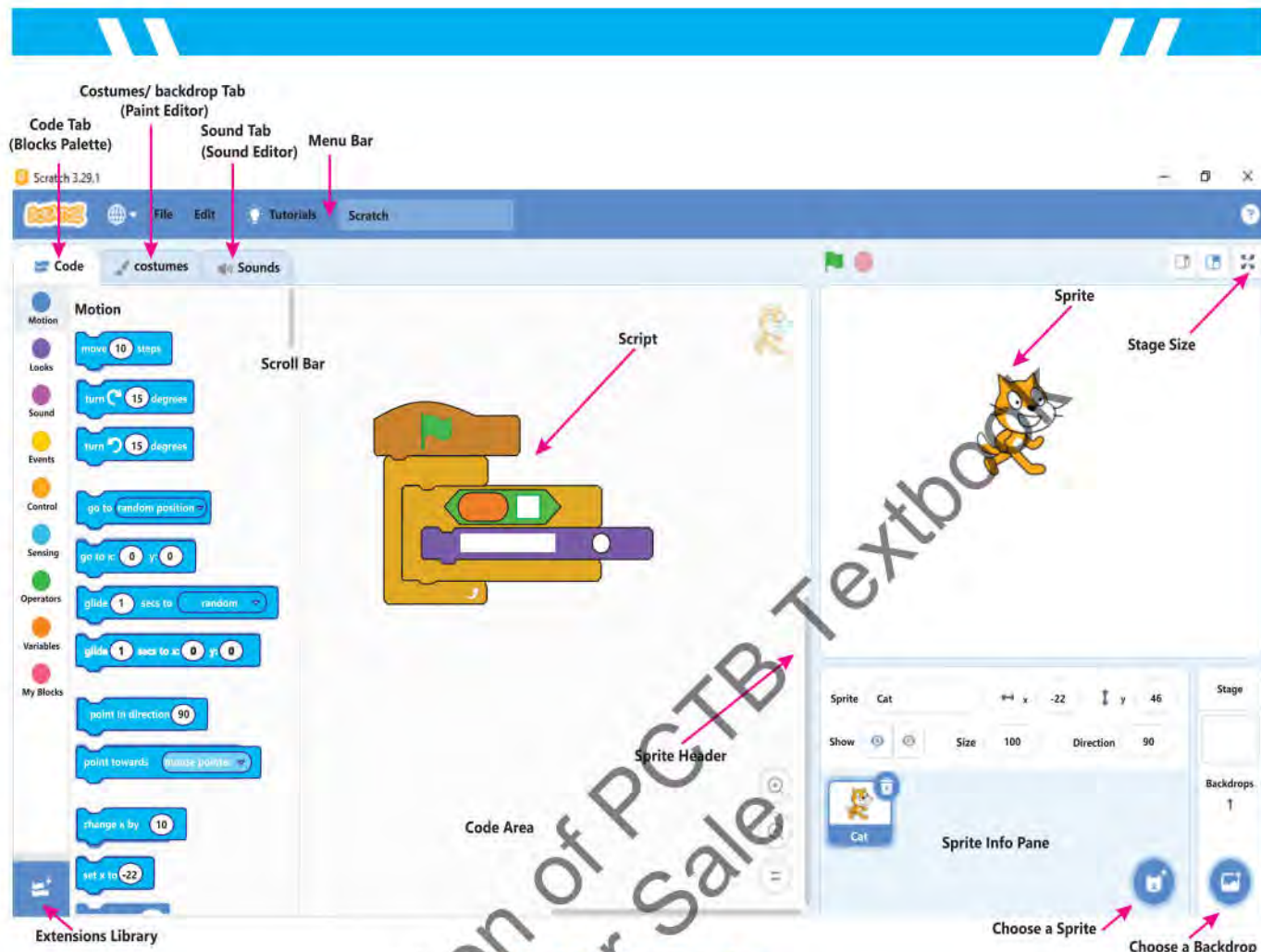


Fig. 5.5 Scratch Interface

Interface parts	Description
Block categories	This shows the category of the blocks. You can click on the category to see the script blocks it contains.
Block Palettes	It has the list of blocks that can be added to your program when creating it. To add a block, you simply click on it and drag it to the script area.
Script Area	This is the place where you add the script blocks to create a program.
Stage	This is where the program runs and you can see Sprite in action.
Sprite List	As it suggests from the name it shows the sprite used in the program. We can add, delete, or modify Sprites, or change the stage background (backdrop) from here.
X and Y coordinates	Tell us the exact X and Y coordinates of the sprite on stage. Whereas location (0,0) is in the middle of the stage.

Creating a Program in Scratch

To create a program in the scratch, you add blocks to the script area. You then click on the block category that has the block you want to add.

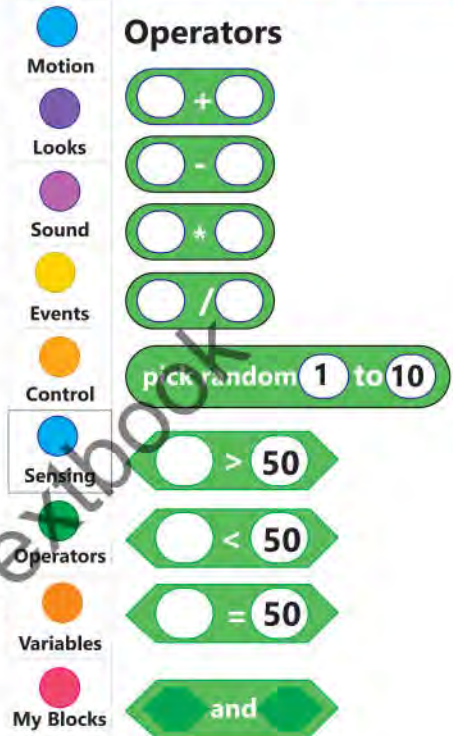
When we click on the block category, we will see the list of blocks it contains. There are several block categories to choose from:

Tips:

To delete a block from the script, we right click on the block and choose Delete from the menu that appears. To undelete the block, we press Ctrl + Z on the keyboard.

Tip:

You can open a program that you have previously saved from the file menu. Click on Load from my computer.



To add a block to our program, we click and drag it to the script area. If the other blocks are already there, a grey color area will appear, showing you where the new block should fit in

Block categories	Description
Motion	Has blocks to enables sprite to move.
Control	Has blocks that control the script and the flow of instructions.
Looks	Has blocks that change the way Sprite looks. You can change the color and size of Sprite. You can make Sprite "speak" and also hide/show it on the stage from this category.
Sensing	Has blocks to help the Sprite detect things in its environment. It is from this category that you can choose blocks that let Sprite ask questions.
Sound	Has blocks to play sounds and control sound settings.
Operators	Has blocks to perform arithmetic, string and Boolean operations.
Variables	Has blocks that allow the user to create and use variables in the script.

the script.

To run the script and see Sprite in action, we click on any of the blocks in the Script area. It is important for you to save your created project to be able to edit or run it later. To do so, you have to click on the file menu on the top and click on Save to our computer. You make sure that you give your file a meaningful name and save it in a personal folder in your computer.

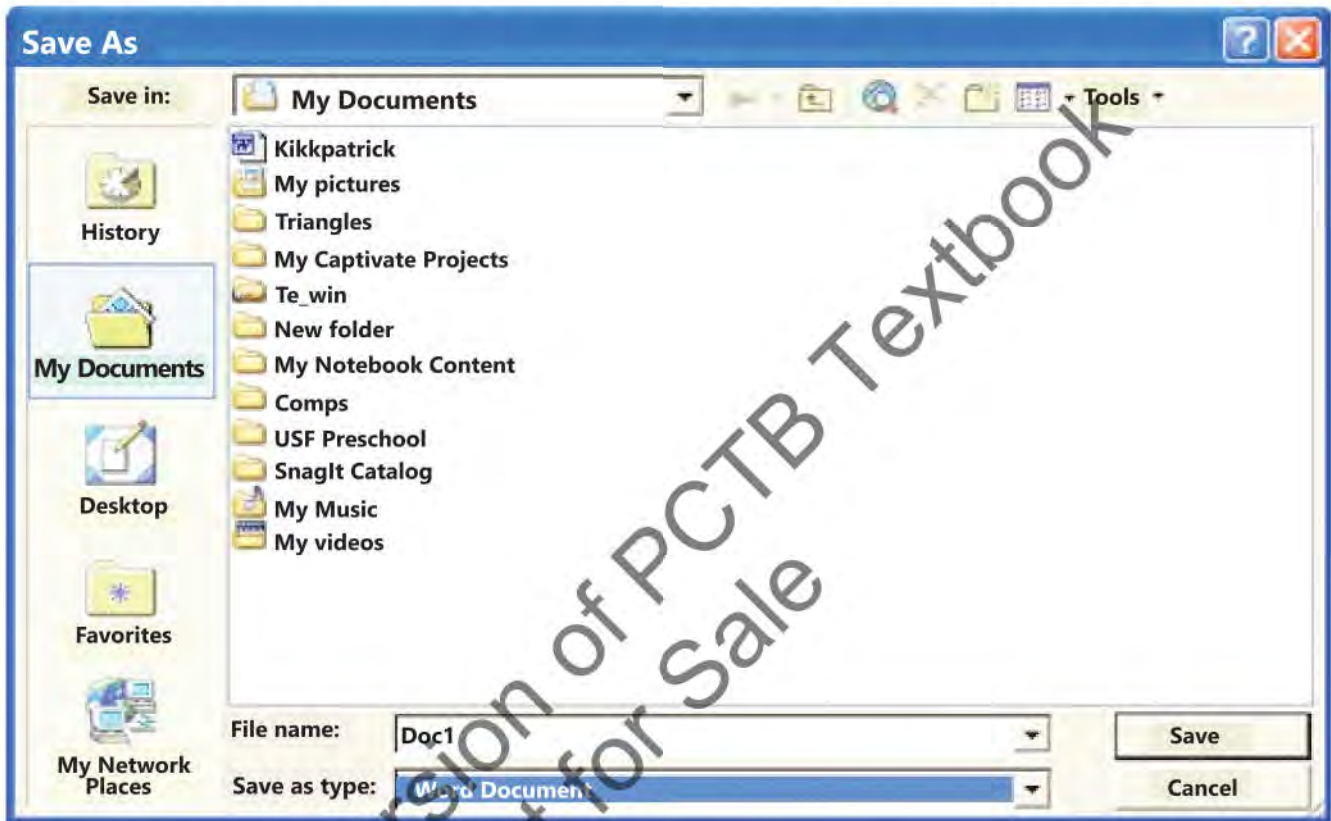


Fig. 5.6 Saving Scratch Program

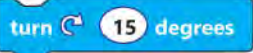
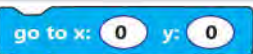
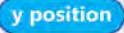
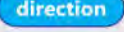
Blocks:

Below are the different block categories, and a description of the blocks in them:

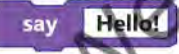
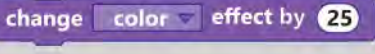
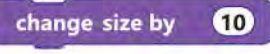
Try It Yourself: Ask the User

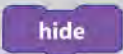
In this Try It Yourself exercise, you have the Scratch Cat ask the player if he or she wants the Cat to grow or shrink in size. Depending upon the player's answer, the Cat then obeys the player's command. You should create a new project that is set up the same way as what you had in the previous exercise. One important change: Add a second backdrop to the Stage, and name it end. You can use the Fill tool, which you'll learn about in Hour 21, "Creating Your Own Sprites and Backdrops," to create a black screen. You can then use the Text tool to add a simple "The End" banner, which you can see in the solution file.

Motion block category:

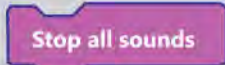
Motion block	What it does?
	Moving sprites.
 	Turning sprites.
	Making sprites move to a given point on the stage, to another sprite or the mouse pointer. This movement can be instant using the go to blocks, or gradual using the glide block.
  	Changing the x and y co-ordinates of the sprite on the stage, either by altering it from its current value (change x/y by) or by setting it to a fixed amount (set x/y to).
	Making the sprite bounce if it hits the edge of the stage.
	Altering the style with which a sprite rotates.
     	Setting a sprite's x or y co-ordinates or the direction in which it's traveling to be displayed on the stage.

Looks block category:

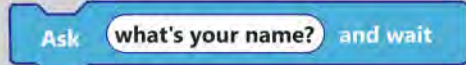
Looks block	What it does?
	Sprite displays text in a speech bubble for a number of seconds.
	Sprite display text in the speech bubble.
	Sprite displays a text in the thought bubble for the number of seconds.
	Sprite displays text in the though bubble.
	Changes color effect of the Sprite by the amount.
	Changes the size of the Sprite by the amount.
	Changes the size of the Sprite by the percentage of the original size

	Makes Sprite appear on the stage.
	Makes the Sprite disappear from the stage.
	Will remove any graphics effects applied, such as change in the color effects.

Sound block category:

Sound Category	What it does?
	Starts to play the sound and continues with the next block even if the sound displayed is still playing.
	Plays the sound and waits for it to finish before continuing to the next block.
	Stops all the sound splaying.

Sensing block Category:

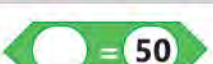
Sensing Category	What it does?
	Sprite can ask user a question and waits for the response.
	Store the user's response to the question asked by the Sprite.

Scratch has 3 operators that allow you to compare the relationship between two values or variables. It will compare the two and decide whether it is true or false. If the comparison is true, the program will go down to the next line of code and do what is there. If the comparison is false the code will not execute. The three relational operators are:

1. greater than
2. less than
3. equal to

Operators Block Category:

Operators Block	What it does?
	Adds two numbers
	Subtract the second number from the first.
	Multiplies the two numbers.
	Divides the first number with the second number.
	Returns random number whose value is between the two numbers specified.

	Returns TRUE if the first number is less than the second number. Otherwise, it returns FALSE.
	Returns TRUE if the first number equals to the second number. Otherwise, it returns FALSE.
	Returns TRUE if first number is greater than the second number. Otherwise, it returns FALSE.
	Joins two stings together to form one bigger string.

Operator	Meaning	Example
	greater than	 is price greater than 2,000?
	less than	 is price less than 2,000?
	equal to	 is price equal to 2,000?

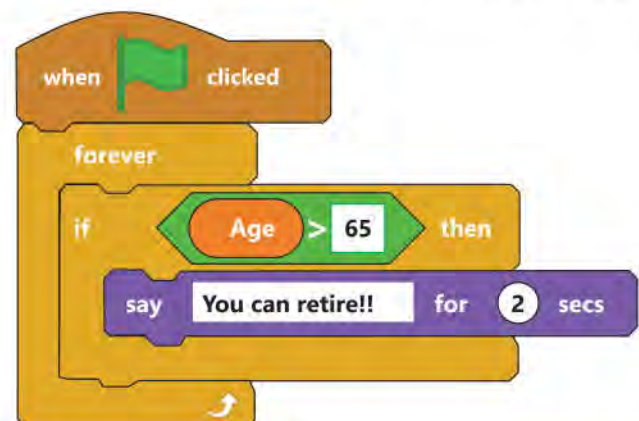
Scratch has 3 operators that allow you to compare the relationship between two values or variables. It will compare the two and decide whether it is true or false. If the comparison is true, the program will go down to the next line of code and do what is there. If the comparison is false the code will not execute. The three relational operators are:

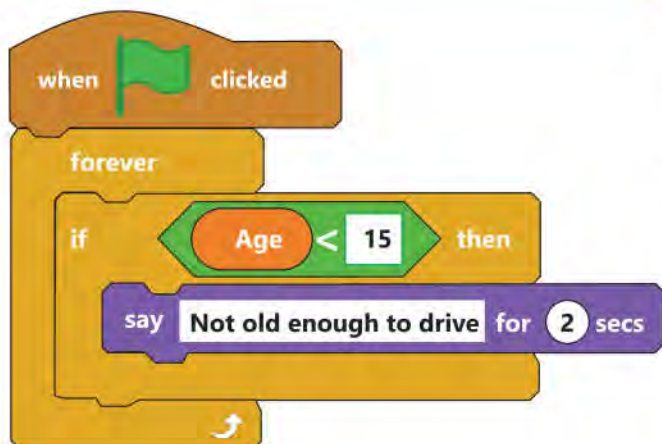
1. greater than
2. less than
3. equal to

Greater Than

The block checks if the first value is greater than the other value. If it is less, the block returns true; if not, it returns false. This block works with letters too, not just numbers. In Scratch, letters at the top of the alphabet (e.g. a, b, c) are worth less than letters at the end (e.g. x, y, z).

When the green flag is clicked, this code will forever check if the value in the age variable is greater than the value of 65. If the value is greater than 65, the sprite will say "You can retire" for 2 seconds. Otherwise nothing will happen.





When the green flag is clicked, this code will forever check if the value in the age variable is less than the value of 15. If the value of age is less than 25, the sprite will say "Not Old enough to drive" for 2 seconds. Otherwise nothing will happen.

Controls Block Category:

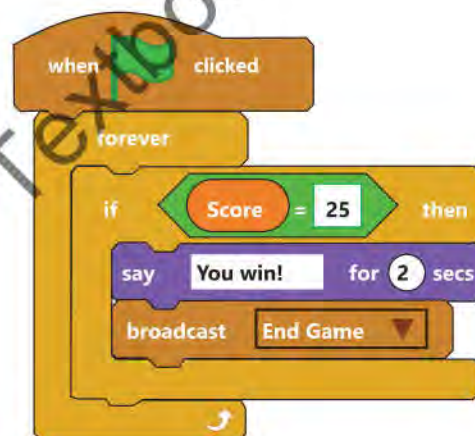
Control block	What it does?
	Checks the condition specified if the condition is TRUE, it runs the blocks inside.
	Checks the condition specified. If the condition is TRUE, it runs the blocks inside the IF part. Otherwise, it runs the blocks inside the Else part.

Event Block Category:

Event block	What it does?
	Program start its execution when click on
	We can choose the key for execution of the program
	Program start its execution when click on sprite.

Less than

The block checks if the first value is less than the second value. If it is less, the block returns true; if not, it returns false. This block works with letters too, as well as numbers. In Scratch, letters at the top of the alphabet (e.g. a, b, c) are worth less than letters at the end (e.g. x, y, z).



Equals to

The block checks if the first value is equal to the other value. If the values are equal, the block returns true; if not, false. When the green flag is clicked, this code will forever check if the value inside the score variable is equal to the value of 25. If the value of score is equal to 25, the sprite will say "You Win!" for 2 seconds and then broadcast the End Game message.

Types of Loops in Scratch

In Scratch, there are three different types of loops. They are "repeat", "repeat until", and "forever" loops. These loop blocks are found in the **"Control drawer"**.

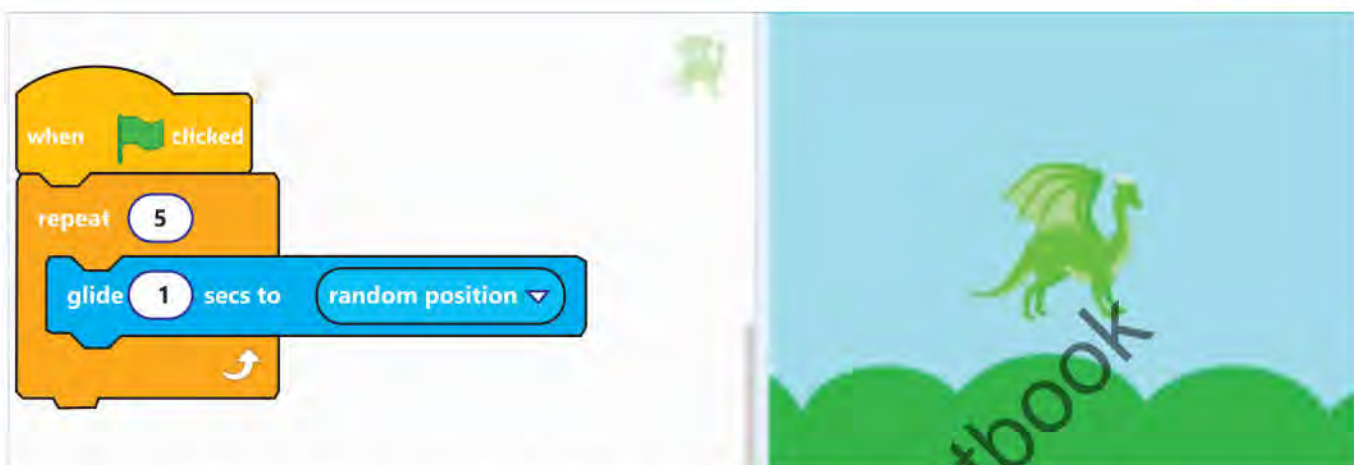


Usage of Loops in Scratch

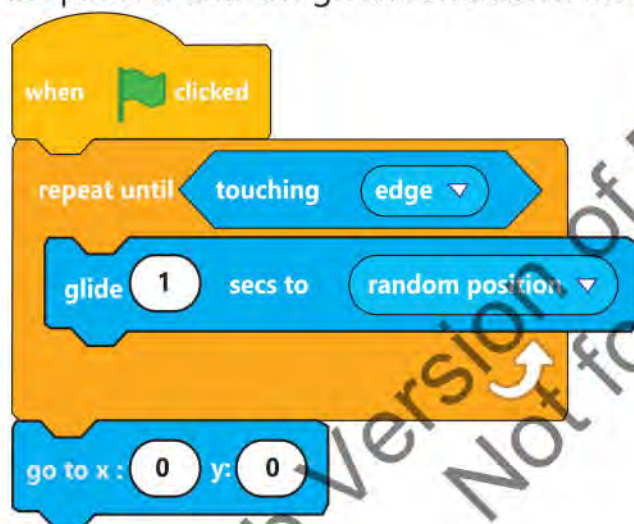
In this section, we are going to see how loops are being used in Scratch. Forever loop: Forever loop is used to act continuously. The loop will not stop anytime. For instance, look at the code given in the image below:



The output is, the cat sprite will move 10 steps and turn back if it touches the edges. This process continues forever, endlessly. To view the output, click this link [Repeat loop](#): A repeat loop is used to perform an action number of times. The loop will stop after the nth time. For example, if you want to do an action 10 times you can make use of this block. Let us see an example to demonstrate this.



If you execute the above code, the dragon will glide to a random position repeatedly for 5 times. After that, it will stop gliding. Repeat until loop: Repeat until loop is used to repeat the process until the given condition is met. Look at the following code.



If you run the above code, the cat will glide to a random position until it touches the edges. Once it touches any edge it will go to the center or origin which is (0,0)

How to Create a Breakable Loop in Scratch. Now let us see how you can create a breakable loop in Scratch. There are numerous methods for breaking a loop in between. I'll go over the most common methods here.

Using If condition First, we are going to see how to break a loop using the if condition. Have a look at the below code.



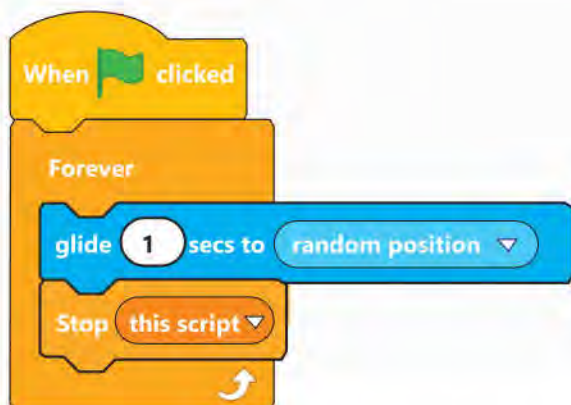
Here the cat will go to a random position 5 times because of the repeat loop. But if you touch the cat with the mouse pointer it will disappear. So the loop gets terminated because of the "if" condition. Check the output here.

In the same way, you can break a forever loop using the if condition. Try this code and check the output.



Using stop the script

Another way of breaking the loop is by using the "stop the script" block

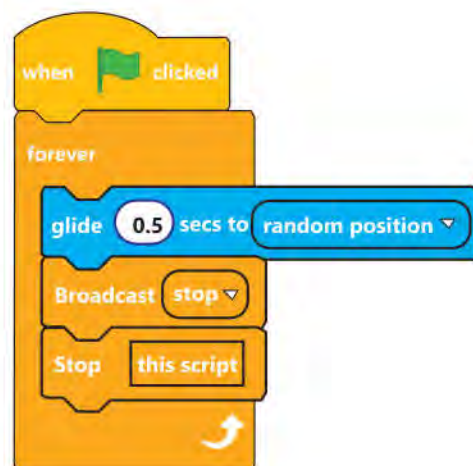
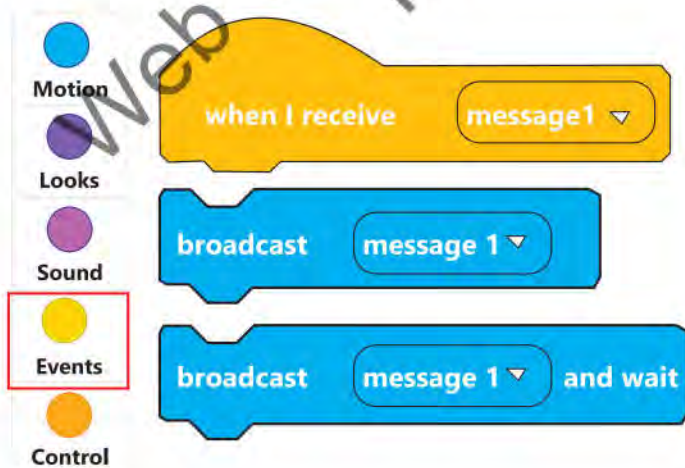


In the above code, the loop is getting terminated using the "stop the script" block. Run this code and see how to break the forever loop using stop the script.

Using broadcast

We can also use a broadcast block to break a loop. You can see this block in the Events drawer.

In the following code, we use a broadcast block to create a breakable loop. When the green flag is clicked, the cat glides to a random position and the forever loop gets terminated when the stop message is broadcast. When the stop message is received the cat goes to



the center and says "Hello". Click the link to view the output.

Repetition in Scratch

We have seen how to apply action statement and decision structures in Scratch. In the



lesson, we will learn how to apply repetition structures. Like decision structures, Repetition structures can be added from the  category.

There are three useful repetitions blocks that we will learn:

1. "forever" runs all the blocks inside it over and over again.
2. "repeat" runs the blocks inside a specified number of times.
3. "repeat until" continuously runs the blocks inside it UNTIL the condition stated is TRUE.

5.6 Debug a computer program.

What is debugging?

Software programs in their developing process have to undergo heavy testing, updating, troubleshooting, and maintenance. Usually, this developed software contains **errors and bugs**, which are removed in routine with constant updates.

Hence **debugging** is the process of **fixing of bug** in the software, bugs can be as an error.

The process of debugging can refer to identifying, analyzing and then eradicating errors. This process initiates when the software program fails to execute properly and concludes when it accomplishes the problem successfully by testing software. This is an extremely **complex** and **tedious** task because errors need to be resolved at all stages of debugging.

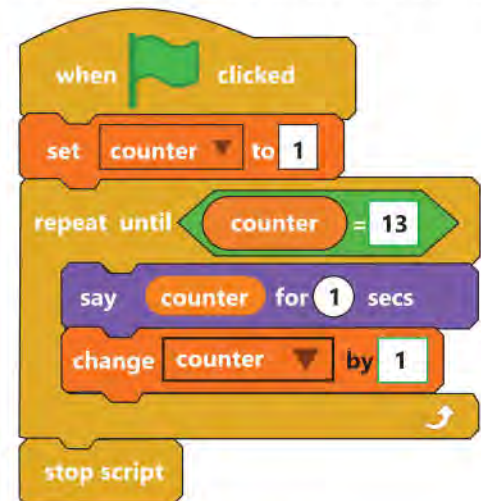


Fig. 5.7 Scratch

Why do we need debugging?

The process of debugging starts the very moment the code of the software is created. It then continues in successive stages as code is combined with other units of programming to form a software product. Debugging is an important part of determining why an operating system, program or application is malfunctioning. It has several benefits that are mentioned below:

- It reports an error condition immediately which allows earlier detection of an error. It makes the process of software development stress-free and straightforward for the use of the user.
- It is through debugging that the developer can avoid complex one-use testing code to effectively save time and energy in development of the software.
- Debugging helps the developer of the program in reducing the use of information that is useless and is not needed.
- It also provides maximum useful information of data structures and allows easy interpretation.

Steps involved in Debugging:

As explained earlier, debugging is a complex process of removing the existing and potential errors in a program, it needs to be done in a specific way. The different steps involved in debugging:



Fig. 5.8 Debugging steps

1. Identification of the Error: Identification of error is the initial and the integral part of the entire process of Debugging. An incorrect identification of an error can be ambiguous and results in is time wastage. It is for this reason that production errors usually reported by users are hard to interpret and often misleading. It is very important to identify the actual error.

2. Find the Location of the error: After the correct identification, you need to go through the code to locate the exact spot where the error occurred. At this stage, one needs to focus on finding the error instead of understanding it.

3. Analyze the Error: In the third step, you need to use a bottom-up approach from the error location and analyze the code. This helps in understanding the error better. Analyzing a bug mainly has two goals, such as checking around the error for other errors to be found, and to make sure about the risks of entering any collateral damage in the fix.

4. Prove the Analysis: Once you have analysis the bug, you need to scrutinize the program to look for a few more errors that may appear on the application. This step involves writing automated tests for these areas with the help of a test framework.

5. Cover Lateral Damage: In this stage, you need to create or gather all the unit tests for the code where you are going to make changes. Now, if you run these unit tests, they all should pass.

6. Fix & Validate: The final stage is to fix all the errors and run all the test scripts to check if they all pass.

Summary

- A program is a set of instructions that is used by the computer to perform a specific task.
- Software can consists of numerous programs that work in collaboration to create different applications and computer systems.
- Scratch is a visual programming language that doesn't require writing of commands.
- Programming is how you get computers to solve a problem.
- The programmer writes the instructions in code. The code is written text, using the rules of the computer language.
- The five generations of languages are
 - Machine language
 - Assembly languages
 - High-level languages
 - Very high-level languages
 - Natural languages
- All programming language use program constructs. Some of the basic constructs are sequence, selection and repetition.
- A constant is a value that remains consistent during the execution of a program.
- A variable is defined as a measure that might change its value during the execution of a program.
- Syntax refers to the spellings and grammar of language used for programming.
- Scratch is a programming software that makes it easy for us to create interactive games, animations and stories.
- Software programs in their developing process have to undergo heavy testing, updating, troubleshooting, and maintenance.
- Debugging tool, (also known as a debugger) is a computer program that identifies coding errors at different stages of development.



Exercise

Tick (✓) the Correct option:

1. A _____ is a set of instruction that is used by the computer to perform a specific task.
a. Decision making b. Program c. Tasks d. Instructions
2. _____ is a visual programming software.

- a. Word b. Excel c. Scratch d. Microsoft Windows
3. The programmer who uses a/an _____ language requires a translator to convert the assembly language program into machine language.
- a. Low-Level b. High-Level c. Very high-level d. Natural
4. A _____ is a value that remains consistent during the execution of a program.
- a. Numbers b. Variable c. Algorithm d. Constant
5. The character in Scratch is called _____.
- a. Kodu b. Sprite c. Cat d. Program
6. The _____ is where we create the program in scratch.
- a. Sprite list b. Block palette c. Stage d. Script area
7. The _____ category in scratch has the blocks for sprite to ask questions.
- a. Looks b. Sensing c. Sound d. Operators
8. _____ is the process to test the software to eliminate the errors in it.
- a. Problem solving b. Updating c. Developing d. Debugging
9. Backward analysis of the problem traces the program backward from the location of failure message in order to identify the region of faulty code.
- a. Backward analysis b. Forward analysis c. Debugging d. Fix and validate
10. You can open the previously saved program from the computer by clicking on the _____ menu.
- a. View b. Save c. File d. Edit

Briefly answer the following questions:

1. What is the function of a program?
2. What is a programming language?
3. Briefly explain three types of programming language. Also explain the difference between them?
4. What is Scratch?
5. What is the difference between the script area and stage?
6. Explain the strategies of debugging?
7. Write a note on steps of debugging.

Fill in the blank with the appropriate terms.

1. The _____ block category has the block to play sounds.
2. The _____ block category has the block to allow Sprite to ask question.
3. The _____ block category enables the Sprite to move.
4. The _____ block category has the blocks to control the flow of instructions.
5. The _____ Block category has the blocks to help Sprite detect its environment.

Project Based Questions:

1: Make the following stage along with two sprites



On clicking Dragon shall move 1 step towards bat
On clicking Bat shall move at random position.

2: Create a program in scratch

Create a program in scratch in which a ball (sprite) will start moving on pressing space bar. The ball will move automatically once it starts moving and will bounce back from boundaries of the screen,

3: Create a multiplication game in Scratch.

The sprite welcomes the user with a welcome message.

The sprite then asks the user about the product of two random numbers (each with a random value between 1 – 12)

If the user enters the correct answer, the sprite changes color and displays a "well done" message.

Digital Citizenship

Students Learning Outcomes

- Identify essentials of good digital citizenship such as safe and responsible technology use.
- Recognize key concepts of copyright, plagiarism, and piracy, and define ethical standards of sourcing online information.
- Examine ethical issues that arise in ICT while surfing online.
- Analyze the importance of being safe, responsible, and respectful online.
- Identify health-related issues of using ICT devices.
- List school ICT lab rules.
- Use devices responsibly
- Demonstrate proper posture when using devices, and healthy behavior such as taking breaks to avoid eye and body strain.
- Identify steps to secure information privacy and confidentiality.
- Identify possible dangers of the internet and related security.

6.1 Citizen and Citizenship

Member of a community is known as a citizen. For Example, we are living in Pakistan therefore we are citizens of Pakistan. A citizen must comply with following responsibilities:

- Be honest and trustworthy.
- Follow rules and laws.
- Respect the rights of others.
- Practice tolerance
- Be informed about the world around you.
- Respect the property of others.
- Be compassionate.
- Take responsibility for your actions.
- Pay taxes

A nation grants certain rights and privileges to its citizens. In return, citizens are expected to obey their country's laws and defend it against its enemies.



6.2 Digital Citizen

A person who develops the skills to effectively use the internet and other digital technology, in order to engage in society, politics and government is known as Digital Citizen. However, a good digital citizen is someone who is informed about the various issues that come across using digital technology.



6.3 Digital Citizenship

Digital citizenship is the ability of a citizen to safely and responsibly access digital technologies being an active and respectful member of society.

6.3.1 Importance of digital citizenship

We consider that everyone, using internet connection is a digital citizen, that's why the concept of digital citizenship becomes a part of our lives. No matter what age a person, knowing how to stay safe and respectful is a necessity in digital society.



Fig. 6.1 Elements of digital citizenship

6.3.2 Elements of digital citizenship

Let's explore some elements of digital citizenship. Some of the essential elements of digital citizenship are:

- Have access to Phone, computers and internet
- Understand how technology shapes our society
- Make online communication possible
- Being confident and capable of using ICT

6.3.3 Essentials of good digital citizen

A good digital citizen is one who knows what is right and wrong and makes good choices while using technology. As we want our kids to be good citizens in the real world, we also want the same in the digital world. Characteristics of a good digital citizen includes:

- Being safe and Responsible whenever you go online.
- Protects your data
- Provide freedom of speech
- Introduces cyber security



Fig. 6.2 Elements of good digital citizen

- Using technology in educational and cultural activities
- Using critical thinking on internet
- Respecting freedom of speech and privacy of others
- Promoting the values of digital citizenship

Computer Lab Rules:

- No food or drinks in computer lab.
- Do not go on unapproved sites.
- Only use your assigned computer.
- Do not change the settings on the computer.
- Ask permission to download.
- Ask permission to print documents
- Save your work often.
- Turn computer monitors off when asked by your teacher.

6.4 Copyright

Copyright is a type of intellectual property rights that protect original works of an owner. In copyright law, there are different types of works, including paintings, photographs, illustrations, musical compositions, sound recordings, computer programs, books, poems, blog posts, movies, architectural works, plays, and so much more.



Fig. 6.3 Copyright

6.5 Plagiarism

Presenting other's work or ideas as your own, with or without consent is called plagiarism. This covers all published and unpublished material whether in electronic or in printed form. Plagiarism is academic dishonesty and a disciplinary offence.

6.5.1 Types of plagiarism

There are various types of plagiarism some of them are:

- **Global plagiarism:** means plagiarizing an entire text.
- **Paraphrasing plagiarism:** means rephrasing someone else's ideas and presenting them as if they were your own original thoughts.
- **Patchwork plagiarism:** means copying phrases and ideas from different sources and compiling them into a new text.
- **Self-plagiarism:** means recycling previous work that you've already submitted or

published.

6.6 Piracy

The act of illegally reproducing copyrighted material, such as books, computer programs, and films is called piracy.

Do you Know?

Those who conduct acts of piracy are called pirates.

6.7 Ethical Standards of Sourcing Online Information

You need to be aware of where to look for information, how to access it and how to use it. You must also be able to analyze your sources to check that they are relevant and of a suitable nature to be included within your work. We can use following aspects to analyze the quality of a source:

Currency: The timeliness of the information

Relevancy: The importance of the information to your context

Authority: The source of the information

Accuracy: The reliability and correctness of the content

Purpose: The reason for which the information exists

6.8.1 Ethical Issues While Surfing Online

The most commonly reported ethical issues are:

Participant privacy:

It refers to an individual's control over sharing personal information (physical, behavioral, or intellectual).

Confidentiality:

Confidentiality represents an agreement between you and other participants that their identities will not be disclosed unless they have agreed otherwise.

Anonymity:

It refers that you do not collect *any* identifiers that link responses to a specific individual. Even you, do not know the identity of the respondent.



Fig. 6.4 Ethical Standards

6.8.2 Being Safe and Responsible Online

Being a responsible digital citizen means having skills to take part in online community life in an ethical and respectful way. Responsible digital citizenship also means:

- Behaving lawfully
- Protecting your privacy and that of others
- Recognizing your rights and responsibilities when using digital media

To encourage people to be responsible, safe and respectful online, follow the given rules:

- Don't share your personal information online.
- Think about what you are sharing before you share.
- Always seek permission before you share a picture of someone else online.
- Don't speak to strangers online.
- Tell an adult if someone asks to meet you online.

Finally, remember, it is important to keep yourself safe online.



Fig. 6.5 Being Safe and Responsible Online

6.9 Health-related Issues of using ICT Devices

If we use a computer for many hours, there are some health issues that might affect us. Some of them are:

6.9.1 Eye-Strain

One health issue that can occur after using computers for a long time is eye-strain. This is caused by looking at a monitor which is a constant distance away. The muscles that focus your eyes do not move, and so get tired and painful. Eye-strain can also cause headaches. We should take regular breaks to avoid Eye-Strain problem.

6.9.2 Back and Neckache

Many people suffer from back and neck pain after working at a computer for a long time. This is usually due to them having a bad sitting posture.

6.9.3 Repetitive Strain Injury (RSI) in Wrists and Hands

Any repetitive movement (same movement over and over again) can result in a health problem called repetitive strain injury (RSI).

In particular, typing and using a mouse for long periods are common causes of RSI in the wrist (it is often called carpal-tunnel syndrome). Take regular breaks from typing or using the mouse.

6.10 Proper posture when using Computer

Proper posture has been described in the following figure, mentioning the correct sitting style. Always keep in mind the proper posture of sitting when and where you operate the computer. This posture will make you physically comfortable and ease.



Fig. 6.6 Proper Posture of Using Computer

Summary

- Member of a community is known as a citizen. Citizens must obey their country's laws and defend it against its enemies.
- Digital citizenship is the ability of a citizen to safely and responsibly access digital technologies being an active and respectful member of society.
- A good digital citizen is one who knows what is right and wrong and makes good choices while using technology.
- Being a responsible digital citizen means having skills to take part in online community life in an ethical and respectful way.
- Copyright is a type of intellectual property rights that protect original works of an owner.
- Presenting other's work or ideas as your own, with or without consent is called plagiarism.
- The act of illegally reproducing copyrighted material, such as books, computer programs, and films is called piracy.
- Eye-Strain, Back and Neck Ache and Repetitive Strain Injury are the issues that you can face with excessive use of ICT devices.



Exercise

Tick (✓) the Correct option:

- Which of the following responsibility a citizen must comply with:
a. Follow rules and laws b. Respect the rights of others
a. Practice tolerance d. All
- A person who develops the skills to effectively use the internet and other digital technology is called:
a. Citizen b. Digital Citizen
c. New citizen d. Technical citizen
- Responsible digital citizenship also means:
a. Behaving lawfully b. Protecting your privacy and that of others
c. Recognizing your rights d. All
- Which of following is not computer lab rule:
a. No food or drinks b. Save your work often
c. Do not use printer in lab d. Do not go on unapproved sites
- _____ is a type of intellectual property rights that protect original works of an owner.
a. Plagiarism b. Copy right c. Piracy d. None

6. Presenting other's work or ideas as your own, with or without consent is called:

- a. Plagiarism b. Copy right c. Piracy d. None

7. _____ plagiarism means plagiarizing an entire text.

- a. Self b. Global c. Patchwork d. Paraphrasing

8. The act of illegally reproducing copy righted material is called:

- a. Plagiarism b. Piracy c. Accuracy d. Paraphrasing

9. _____ plagiarism means recycling your own previous work.

- a. Self b. Global c. Patchwork d. Paraphrasing

10. _____ plagiarism means coping phrases and idea's from different sources.

- a. Self b. Global c. Patchwork d. Paraphrasing

Briefly answer the following questions:

1. Define citizenship.
2. What is digital citizenship?
3. Write the responsibilities of a citizen.
4. Write the basic elements of digital citizenship.
5. Enumerate 5 rules of computer lab.
6. How does copyright protect original material of an owner?
7. How can we say that plagiarism is an offence? Justify your answer.
8. What is piracy?
9. What are the ethical issues while surfing online?
10. Write the rules for being safe and responsible online.

Answer the following questions in detail:

1. Discuss importance of digital citizenship.
2. What do you mean by "be safe and responsible" in digital citizenship?
3. What is plagiarism? Write down its types.
4. Write down ethical standards of sourcing online information.
5. What issues can we face by excessive use of ICT devices?

Activity Based Questions:

1. In-class exercise or homework prompt: Students should identify and demonstrate proper posture when using devices, and know techniques for reducing eye and body strain during use. The teacher divides students into groups and assigns a device e.g. computer, TV, phone, etc. Each group then has to discuss the appropriate usage, proper posture, duration of usage, post-use storing of the device, etc. Students will present their points to the class after discussion.
2. The Start activity is a good opportunity to discuss child safety more broadly. It is important to explain to the students that one of the key strategies when feeling unsafe or uncomfortable, whether online or offline, is to approach a trusted adult. It is recommended that you share with the students the NO-GO-TELL approach. If something or someone is making them feel uncomfortable or unsafe, they should do the following: • Say NO when someone is making you feel uncomfortable or unsafe. • Then GO: leave or run away from that person or situation. • And TELL: talk to a trusted adult about the situation.

Entrepreneurship In Digital Age

Students Learning Outcomes

After completing this unit students will be able to:

- Define the term entrepreneurship
- Identify different types of entrepreneurs and present few examples of entrepreneurs.
- Differentiate between traditional and digital entrepreneurship along with examples.
- Summarize the entrepreneurship process.
- Analyze how traditional could use technology to improve or scale their business.

7.1 What is an entrepreneur?

An entrepreneur is an individual who initiates a new business and bears most of the risks associated and enjoys most of the rewards. It is an entrepreneur who starts a business venture and is responsible for its development. The process of setting up a business is known as entrepreneurship. The entrepreneur is also commonly known as an innovator who sources new ideas, goods, services, and business/or procedures.

Entrepreneur plays a vital role in any economy and its development. It requires the use of the skills and initiative necessary to anticipate demands and bring good ideas to market.

Entrepreneurship that proves to be successful in taking on the risks of creating a startup is rewarded with profits, fame, and continued growth opportunities. Entrepreneurship that fails results in losses and less prevalence in the markets for those who are involved.



Fig. 7.1 Entrepreneurship

7.2 Types of Entrepreneurships

Here are the different types of entrepreneurships:

1. Small business entrepreneurship
2. Large company entrepreneurship
3. Scalable startup entrepreneurship
4. Social entrepreneurship
5. Innovative entrepreneurship
6. Hustler entrepreneurship
7. Imitator entrepreneurship
8. Researcher entrepreneurship
9. Buyer entrepreneurship



1. Small business entrepreneurship

People are interested in small business entrepreneurship are most likely to make a profit that supports their family and a modest lifestyle. This is why most of the businesses are small scale entrepreneurship. The people in this venture are not seeking large-scale profits or venture capital funding. Small business entrepreneurship is often when a person owns and runs his own business and typically hire local employees and family members. Local grocery stores, hairdressers, small boutiques, consultants and plumbers can be categorized in this category of entrepreneurship.



Fig. 7.2 Small grocery store

2. Large company entrepreneurship

Large company entrepreneurship is when a company has a finite amount of life cycles. This type of entrepreneurship is for an advanced professionals who acquire the knowledge of how to sustain innovation. They are often a part of a large team of C-level executives. Large companies often create new services and products based on consumer preferences to meet market demand. Small business entrepreneurship can turn into large company entrepreneurship when the company rapidly grows. This can also happen when a large company acquires them. Companies such as Microsoft, Google and Disney are examples of this kind of entrepreneurship.

3. Scalable startup entrepreneurship

This kind of entrepreneurship is when entrepreneurs believe that their company can bring an revolution in the world. They often receive funding from venture capitalists and hire specialized employees. Scalable startups hunt for things that are missing in the market and create solutions for them. Many of these types of businesses start in Silicon Valley and are technology-focused. They seek rapid expansion and big profit returns. Examples of scalable startups are Facebook, Instagram and Uber.

4. Social entrepreneurship

An entrepreneur who wants to solve social problems with his/her products and services is in this category of entrepreneurship. The primary goal is to make the world a better place. They don't work to make big profits or wealth. Instead, these kinds of entrepreneurs tend to start nonprofit or companies that dedicate themselves to working toward social good.



Fig. 7.3 Social entrepreneurship

5. Innovative entrepreneurship

Innovative entrepreneurs are people who are continuously coming up with new ideas and inventions. They take these ideas and turn them into business ventures. They often target the change in the way people live for the better. This is why innovators tend to be very motivated and passionate people. They look for ways to make their products and services stand out from other things on the market. People like Steve Jobs and Bill Gates are examples of innovative entrepreneurs.

6. Hustler entrepreneurship

People who are willing to work hard and put in consistent effort are considered hustler entrepreneurs. They often start at small scale and work hard towards growing a bigger business with developing skills rather than capital. Their aspirations are what motivates them, and they are willing to do what it takes to achieve their goals. They are willing to experience challenges to get what they want. For example, someone who is a hustler is willing to cold call many people in order to make one sale.

7. Imitator entrepreneurship

Imitators are entrepreneurs who use others' business ideas as inspiration but work towards improving them. They look to make certain products and services better and more profitable. An imitator is a combination of an innovator and a hustler. They are willing to think of new ideas and work hard but the fact remains that they start with some one's inspiration. People who are imitators have a lot of self-confidence and determination as they learn from others' mistakes when making their own business.



Fig. 7.4 Imitator entrepreneurship

8. Researcher entrepreneurship

Researchers take their good time when starting their own business as they want to have the complete knowledge of the product before offering it. They are firm believer in the fact that with the right preparation and information, they have a higher chance of being successful. A researcher makes sure they understand every aspect of their business and have an in-depth understanding of what they are offering. They tend to rely heavily on facts, data and logic rather than their intuition. Detailed business plans are important to them and minimize their chances of failure.

9. Buyer entrepreneurship

A buyer is a type of entrepreneur who uses his/her wealth to fuel the business ventures.

They use their fortunes and monies to buy businesses that they think will be successful. They identify promising businesses, its potential and look to acquire them. Then, they make any management or structural changes they feel are necessary. Their target to grow the businesses with potential as they invest to expand their profits. This kind of entrepreneurship is less risky because they are purchasing already well-established companies.

Examples of digital/Traditional entrepreneurship?

There are numerous entrepreneurs who have shown the world remarkable digital evolution for success. Below mentioned are some notable examples of digital entrepreneurship in detail:

- ❖ Baqar Jafri is a financial journalist and a tech entrepreneur who has graduated from the Institute of Business Administration with a BS degree in Economics and is one of the top entrepreneurs in Pakistan. He plays a significant role in providing people with exact direction about investment in the stock exchange. He is the CEO of 'Investor Lounge,' a platform that helps people to make easier investment decisions. The startup is also very helpful for beginner entrepreneurs to take positive steps and invest in profitable categories on the stock exchange.



- ❖ Nabila Maqsood is currently amongst the top rank entrepreneur in Pakistan. She is a talented and hardworking makeup artist who started her first salon in 1986. At that time, she did not receive much appreciation, but currently, she is well known and on the top of the list in the fashion industry. With her stepping into the fashion industry, she has brought many innovations. The startup she has established from her servant quarter and cutting the hair of her friends and family members has become a famous brand. Nabila Maqsood has also started her makeup brand named ZERO Makeup.



- ❖ Elon Musk is a true genius, and only a fool will deny this fact. He is a visionary genius who first created online Payment Network "PayPal" that changed digital payments landscape. This platform was sold to eBay for US\$ 1.5 billion proving its worth to the world. Elon Musk has also completed other ventures like SpaceX and Tesla that make him one of the most completed entrepreneurs of all time.



- ❖ A renowned name on the list of successful entrepreneurs in Pakistan is Noman Sikandar, founder of Foodpanda. He completed his master's degree in business administration from Lancaster University. He was also the founder of EatOye.



Foodpanda is a famous and valuable food delivery mobile application. Startups have the status of the most successful and perfect services nowadays. However, he has started the journey with his partner from three tables. He is nominated for the best entrepreneur in Pakistan for his persistent struggle.

- ❖ Usama Arjumand is the Founder & CEO of Shopsy.pk – a shopping search engine powered by machine learning and AI. The eCommerce platform offers over 8 million products from 300 online stores and serves over 1 million monthly visitors. Shopsy is currently one of the top 5 most visited shopping platforms in Pakistan.



Usama started his career journey in the United Kingdom more than a decade ago, graduating from the University of Nottingham in 2008 with a BEng in Mechanical Engineering. He has extensive experience in building business ventures and is also currently the Director of Gallery 6, the largest private art gallery in Islamabad. His venture prior to Shopsy, a global marketplace for art, was acquired in the UK.

Differences in Traditional Business and Digital Business

Traditional business has a physical presence. It serves people locally by providing services or products. People themselves visit locating the stores whereas talking about e-commerce business, people in any corner of the world can scroll through the web and find the store. They can shop at any time of the hour and receive the products and services easily. Various companies providing digital marketing services are making the best use of this new business trend.

For the entrepreneurs, who are confused to decide between traditional and digital business must know their differences. Knowing these differences will surely help one to decide. It is because different businesses are suited to different types of markets. Some may want local customer to attract while some wish international customers depending on the size and type of the organization.

Here is a comparison between traditional and digital marketing.

Overhead costs

E business generally has less or no overhead costs because they do not need to have a physical site to sell their product and services. They have a web presence and so people can reach them through internet. People involved in traditional business have to select a prime location, find a place to set and then rent it. For traditional businessmen, the costs do not end up till renting the business. They also need online presence and that cost cannot be eliminated. They have to seek help from digital world like SEO services or paid services to attract the target customers.

Convenience to the customers

The competition is undoubtedly in the favor of e-commerce shopping because of customer's reliability. Shopping sites such as – Amazon, Flipkart and Myntra have replaced

the thoughts of people getting out of their houses in search of quality products. However, there are a bunch of people who still prefer live shopping to physically examine the product before purchasing.

Marketing programs

There is no doubt in the fact that digital businesses need to have more budget to spend in their marketing programs where in traditional business have limited budget and limited options. Marketing programs in digital world include blogs, attention to social media, content ads etc. Traditional marketers very often take help of this business transformation. They also have to take care of the other modes of marketing such as newspaper ads and pamphlets.

Reputation in front of the customers

No matter how hard e commerce business is working to shine bright, but in terms of reputation, traditional marketers are ahead till date. It seems to be more reliable to the people in terms of the product quality. Traditional marketing exists for more than a century now so people still trust traditional marketing most of the times. Reputation would build up with time and consistency of the brand in case of both digital as well as traditional business set ups.

Time and reliability

When it comes to save time and money in this fast life, e commerce businesses are preferred by people. People can shop in their workplaces by just going through it and make easy transactions. Be it debit, credit, net banking or cash on delivery option. The services are available 24* 7 and so you can shop your favorite items even in the odd hours. There are easy returns and exchanges without any questioning. With this much of reliability, people are loving e-commerce and other web services.

So, these were some of the prominent differences between traditional and digital business. These differences surely do not uplift any of the two but it clearly tells the nature of both kinds of businesses.

Activity	Traditional Mode	E-Commerce Equivalent
Information Collection	Direct Visit	Internet
Marketing	Advertisements, Exhibitions	Website
Pre-Contract Negotiation	Telephone, Fax, Direct Visit	E-mail
Customs Procedures	Paperwork and visiting	Electronic Environment
Banking and Payments	Credit Letters, Bank Drafts	Online Banking
Logistics	Guarantee Letters	Online booking and home delivery

Table 1: Differences between E-Commerce and traditional systems

	Traditional Business Strategy	Digital
Attain a place in the markets	Difficult	Easy
Production and storage	Difficult	Easy
Deployment	Slower	Faster
Workplace	Physical Reunion	Virtual Meeting
Organizational commitment	Easier	More difficult
Contact Style	Face to Face	Using computer and Digital technologies
Organizational structure	Hierarchical	Flexible and collaborative

Table 2. Differences between Traditional and Digital Entrepreneurship

Entrepreneurship Process

1. Discovery
2. Concept Development
3. Resourcing
4. Actualization
5. Harvesting



Fig. 7.5 Entrepreneurship process

1. Discovery

An entrepreneurial process begins with the generation of an idea, wherein the entrepreneur identifies and evaluates the business opportunities. The identification and the evaluation of opportunities is a difficult task; an entrepreneur seeks inputs from all the persons including employees, consumers, channel partners, technical people, etc. to reach to an optimum business opportunity. Once the opportunity has been decided upon, the next step is to evaluate it.

An entrepreneur can evaluate the efficiency of an opportunity by continuously asking certain questions to himself, such as, whether the opportunity is worth investing in, is it sufficiently attractive, are the proposed solutions feasible, is there any competitive advantage, what are the risk associated with it. Above all, an entrepreneur must analyze his

personal skills and hobbies, whether these coincides with the entrepreneurial goals or not.

2. Developing a Business Plan

Once the opportunity is identified, an entrepreneur needs to create a comprehensive business plan. A business plan is critical to the success of any new venture since it acts as a benchmark and the evaluation criteria to see if the organization is moving towards its set goals.

An entrepreneur must dedicate his sufficient time towards its creation, the major components of a business plan are mission and vision statement, goals and objectives, capital requirement, a description of products and services, etc.

3. Resourcing

The third step in the entrepreneurial process is resourcing, wherein the entrepreneur identifies the sources from where the finance and the human resource can be arranged. Here, the entrepreneur finds the investors for its new venture and the personnel to carry out the business activities.

4. Managing the company

Once the funds are raised and the employees are hired, the next step is to initiate the business operations to achieve the set goals. First of all, an entrepreneur must decide the management structure or the hierarchy that is required to solve the operational problems when they arise.

5. Harvesting

The final step in the entrepreneurial process is harvesting wherein, an entrepreneur decides on the future prospects of the business, i.e. its growth and development. Here, the actual growth is compared against the planned growth and then the decision regarding the stability or the expansion of business operations is undertaken accordingly, by an entrepreneur. The entrepreneurial process is to be followed, again and again, whenever any new venture is taken up by an entrepreneur, therefore, it's an ever-ending process.

Analyze how traditional could use technology to improve or scale their business.

1. Manage Projects More Easily, Effectively, and Efficiently

Technology has enabled business owners and leaders to stay on top of their projects by tracking time and progress. With web-based project management tools like Basecamp, Monymoon, and Podio, you can efficiently collaborate with your teams and share access on documents.

Apps like Roambi can read your business data, analyze it and turn it into reports through graphs on your iPad. In Apple is an App called Keynote, which is more relative to PowerPoint regarding the presentation.

In case you happen to be in remodeling, repair or construction business or related fields, displaying pictures of “before and after” offers a compelling proof of the value your service or product can add. The effect of conveying actual benefits of your product or services will definitely turn your prospects into serious buyers.

2. Make Use of Productivity Apps

A worker is known by their tools, and so is a business person. The good news for owners and managers is that they can make use of productivity applications availed by technology: tools that can increase business productivity at a lesser cost. All you need a mobile device and can install apps such as:

- Slack
- Trello
- Podio
- Basecamp
- Asana

Many of these apps are offered free entirely or provided free for a particular level of service, which can be synced with their desktop versions. These productivity apps will get the right things done, without much strain, and with relatively little time invested.

Task Management Software You Really Need



Web-based payment systems help businesses thrive through sending and receiving payments online. Due to many payments' options and their flexibility aspect, web-based payment has enabled many businesses to fetch new customer segments. This is because by having different web-based payment options, you will have many more customers who like using that particular payment option.

We can help you align your team around a clear vision, mission, values, goals and action plans, so you can lead your organization more effectively and get better results.

4. Make Use of Backup Software

Reports of malicious software and hackers are wrecking businesses world over. Most of the businesses that have become victims of a data breach suffer losses in customer trust and brand reputation. The results of a data breach can be costly for organizations of any size.

As an executive or owner, stay vigilant and grab an enterprise backup software as well as recovery and continuity tools. These are tools that use Artificial Intelligence (AI) to flag suspicious files and software.

5. Measure User Engagement

Especially for small or medium sized organizations, Google analytics is a hot tool for measuring user engagement and loyalty. It gives you some stats that indicate how engaged and loyal your active user readership is, which you can then interpret to improve your conversion rate.

You can use it more specifically in targeting a specific audience from your competitors' fan base. Stealing your competitors' customers would mean accelerating your business growth.

6. Make Use of Twitter to Gain New Customers

Twitter is undeniably one of the most powerful tools for promoting your products and services if used rightly.

7. Better Marketing Campaigns

Digital marketing tends to yield better by far results than traditional advertising methods. They have the potential of undertaking marketing campaigns that target specific audience hence increasing conversion rate.

8. Improved Customer Service

Excellent customer service is key to your business success. Other than selling your product or service, you should think of the cumulative experience your customers get when they visit your store or website.

Technology will allow you to set up an online help desk to handle customer issues, schedule appointments or conduct surveys and questionnaires to get customer feedback.

Summary

- An entrepreneur is an individual who initiates a new business and bears most of the risks associated and enjoys most of the rewards.
- The process of setting up a business is known as entrepreneurship.
- The entrepreneur is also commonly known as an innovator who sources new ideas, goods, services, and business/or procedures.
- There are nine different types of entrepreneurships:
 - Small business entrepreneurship
 - Large company entrepreneurship
 - Scalable start up entrepreneurship
 - Social entrepreneurship
 - Innovative entrepreneurship
 - Hustler entrepreneurship
 - Imitator entrepreneurship
 - Researcher entrepreneurship
 - Buyer entrepreneurship

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Exercise

Tick (✓) the Correct option:

1. A/An _____ is an individual who initiates a new business and bears most of the risks associated and enjoys most of the rewards.
a. Buyer b. Seller c. Investor d. Entrepreneur
2. Hiring a virtual assistant can give your business smart tech solutions with a human touch.
a. Technology c. Knowledge
b. Virtual assistant d. Entrepreneurship
3. A _____ business does not require a physical existence.
a. Traditional b. Commercial c. Digital online d. Conventional
4. In _____ entrepreneurship researchers take their good time when starting their own business as they want to have the complete knowledge of the product before offering it.
a. Buyer b. Researcher c. Seller d. Large company
5. E business generally has less or no _____ costs.
a. Hidden b. Fixed c. Overhead d. Variable
6. Entrepreneurship that proves to be successful in taking on the _____ of creating a startup is rewarded with profits, fame, and continued growth opportunities.
a. Cost b. Risks c. Opportunities d. Advantages
7. _____ are entrepreneurs who use others' business ideas as inspiration but work towards improving them.
a. Imitators b. Hustlers c. Scalable d. Social
8. There are _____ types of entrepreneurships.
a. 4 b. 5 c. 7 d. 9
9. The final step in the entrepreneurial process is _____.
a. Planning c. Harvesting
b. Resourcing d. Developing
10. _____ has enabled business owners and leaders to stay on top of their projects by tracking time and progress.
a. Investments b. Risks c. Technology d. Ethics

Short Questions:

1. Define an entrepreneur.
2. What is an entrepreneurship?
3. Explain the difference between traditional and digital entrepreneurship.
4. Elaborate on the difference between small business and large business entrepreneurship.
5. How entrepreneurship helps developing an economy?
6. Briefly explain the process of entrepreneurship.
7. Give two examples of entrepreneurs other than discussed in the chapter.
8. Why an entrepreneur also explained as a risk taker?
9. Why is digital entrepreneurship preferred over the traditional entrepreneurship nowadays?
10. State the difference between E-commerce and traditional systems.

Project Based Learning Questions:

1. Divide the class in two groups. Each group should think of a business plan that they think is worth taking a risk and will seek higher profits. The students should try to sell their idea by convincing the teacher who can act like a potential investor.
2. Research on the world's renowned entrepreneurs who have set an example in the world in making a difference to economy by developing it

Activity Based Question

1. Students should discuss a famous entrepreneur and their professional & personal journey, and present to the class as an individual or a group.

Answers

Unit 1

1	d
2	b
3	c
4	c
5	a
6	d
7	b
8	b
9	d
10	d

Unit 4

1	c
2	a
3	b
4	b
5	d
6	a
7	b
8	b
9	c
10	a

Unit 7

1	d
2	c
3	c
4	b
5	c
6	b
7	a
8	d
9	b
10	c

Unit 2

1	b
2	a
3	c
4	d
5	b
6	d
7	a
8	d
9	c
10	c

Unit 5

1	b
2	c
3	a
4	d
5	b
6	d
7	b
8	d
9	a
10	c

Unit 3

1	c
2	d
3	b
4	b
5	d
6	c
7	a
8	b
9	a
10	d

Unit 6

1	d
2	b
3	d
4	c
5	b
6	a
7	b
8	d
9	a
10	c